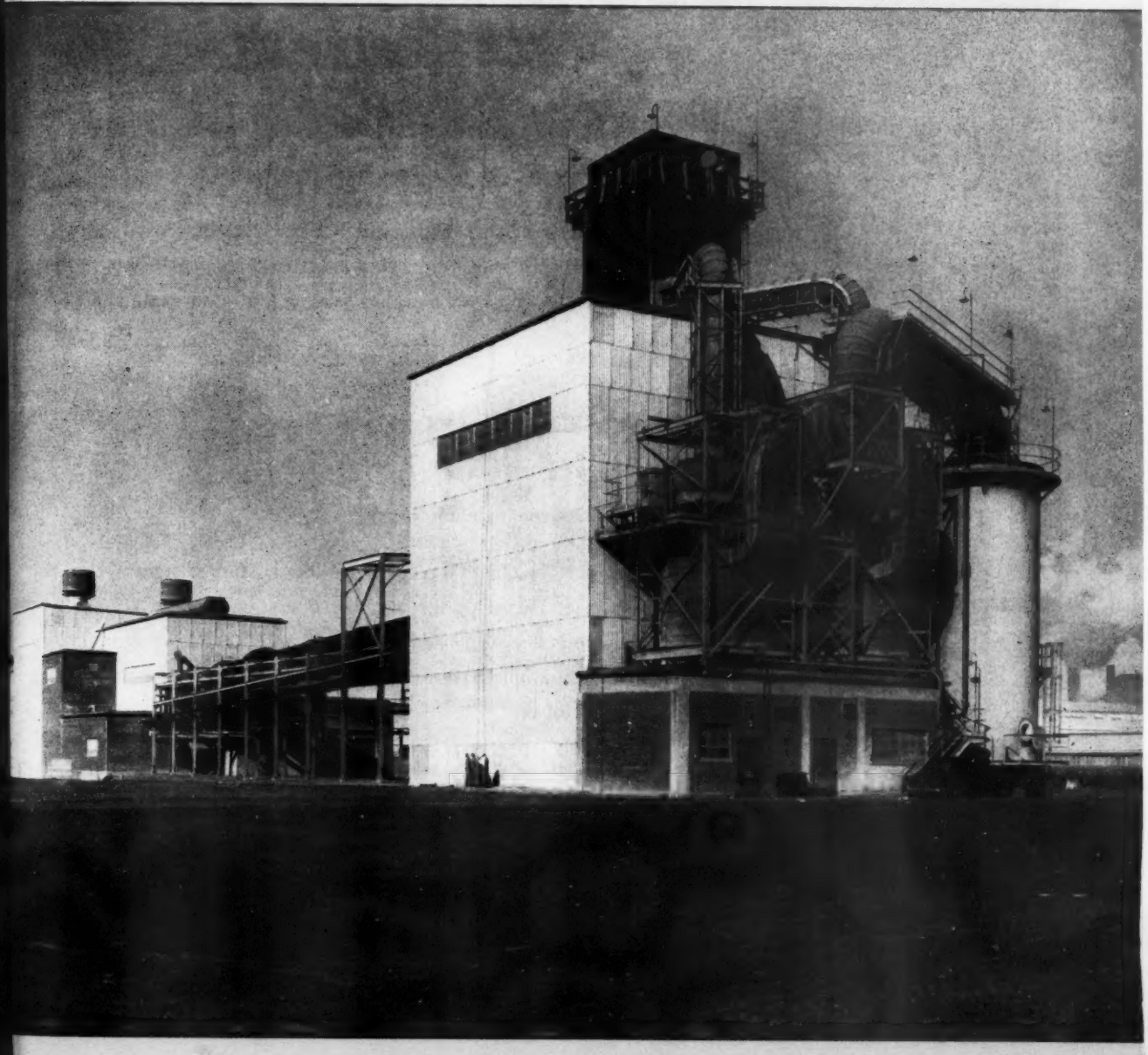
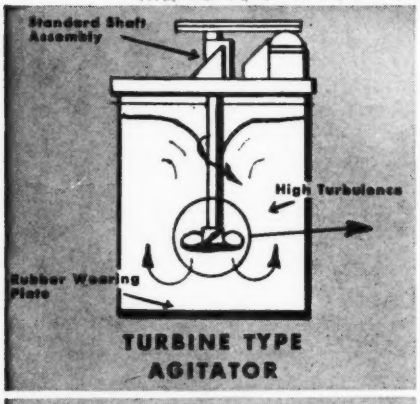
Mining CONGRESS JOURNAL

AMERICAN MINING CONGRESS

MARCH
1957



Here are the tools to help you solve your Agitation problems and *Increase Profits!*

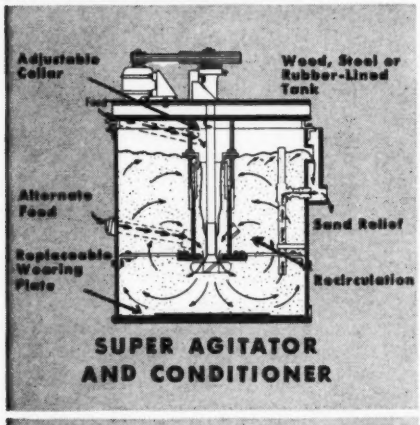


TURBINE TYPE AGITATOR

DENVER Agitators for mixing and leaching

(Copper, uranium, vanadium, lithium, cobalt, zinc)

Denver Agitators and Conditioners are the only machines that are flexible enough to be adapted to meet changing ore conditions. Heavy duty construction gives you dependable service 24 hours a day!

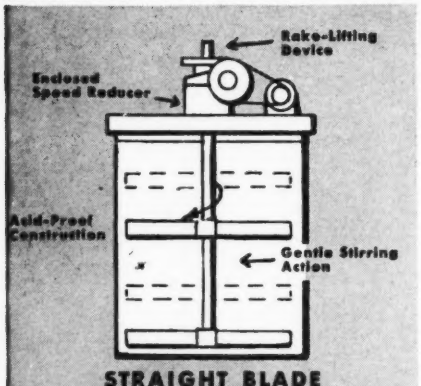


SUPER AGITATOR AND CONDITIONER

DENVER Agitators for flotation

(Barite, phosphate, fluorspar, iron, lead, zinc, copper feldspar)

The patented Denver standpipe gives you a flexible tool to change agitation and aeration to meet your exact requirements. These foolproof machines will mechanically do your job—low maintenance.



STRAIGHT BLADE STIRRER

DENVER Agitators for precipitation

(Vanadium, lithium, uranium, copper)

This new machine was designed by DECO engineers especially to meet the needs for leaching operations in the Uranium industry—complete suspension of solids without excessive agitation. It is another example of how DECO engineers help their customers solve special jobs!

Our Bulletin A2-B4 describes these Denver Agitators in detail.

WHAT DELIVERY DO YOU NEED? INVESTIGATE NEW LOW PRICES!

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT COMPANY 24 HOUR SERVICE

"The firm that make its friends happier, healthier and wealthier"

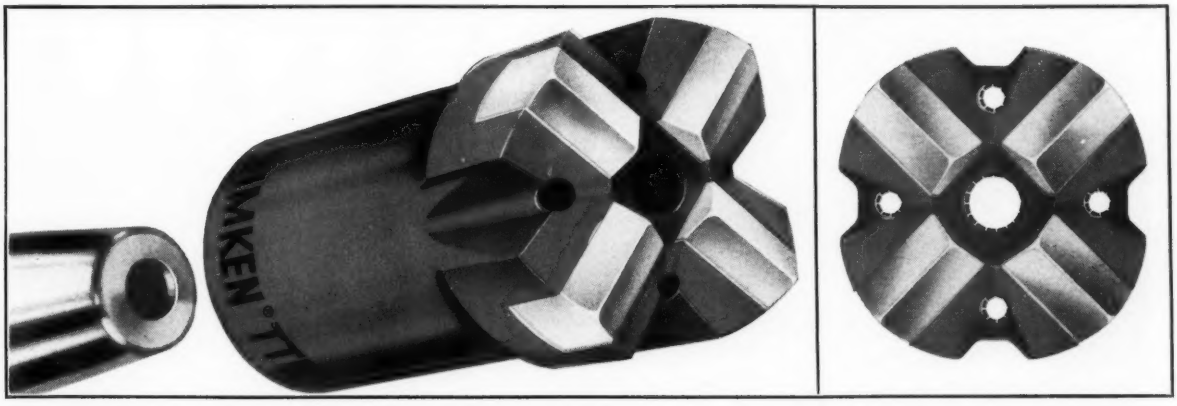
DENVER EQUIPMENT COMPANY

1400 SEVENTEENTH ST. CHerry 4-4466 DENVER 17, COLORADO

Denver • New York • Chicago • Salt Lake City • Toronto • Vancouver • Mexico D.F. • London • Johannesburg

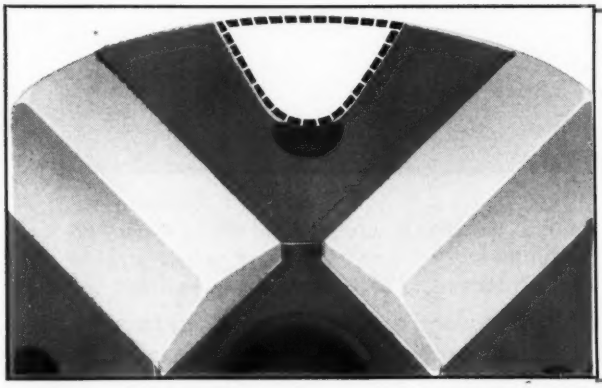
For air-leg drills and light stoping . . .

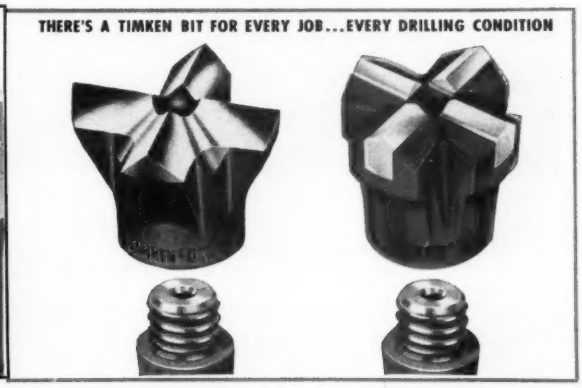
New Timken® Tapered Socket Bit speeds drilling 3 ways!



1. TAPERED SOCKET GIVES MORE SECURE UNION—The new Timken® bit has a tapered socket that provides a more secure union than threads for air-leg drills. Its precision-made taper fits tight to the drill steel yet permits quick and easy bit changes to speed drilling. Breakage is reduced, bit cost cut. New, special analysis carbide inserts give cutting face superior wear-resistance, with added shock-resistance. And a body of Timken electric furnace fine alloy steel helps Timken tapered bits give you lowest cost per foot-of-hole.

2. 5-FRONT-HOLE JET ACTION WASHES CHIPS BACK FASTER—New frontal design shoots five jets of water in front of the bit to wash away chips faster. Bit spends less time "drilling" chips, more time drilling new rock.





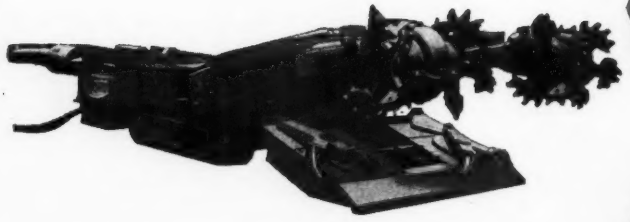
3. DEEPER, WIDER WING CLEARANCE SPEEDS CHIP REMOVAL—Extra deep, wider clearance between cutting wings permits water to carry chips away faster from the cutting face of the bit. This faster chip flow helps increase cutting efficiency, speeds drilling. New Timken bits come in three popular sizes: 1¼", 1⅜" and 1½". Write for free brochure. The Timken Roller bearing Company, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN MULTI-USE BIT—Your most economical bit for ordinary ground. With correct and controlled reconditioning, it gives lowest cost per foot-of-hole when full increments of steel can be used. And it is interchangeable with Timken threaded carbide insert bits on the same drill steel. **NEW TIMKEN THREADED CARBIDE BIT**—For other tough drilling jobs. New features speed chip removal: five front holes; deeper, wider clearance between wings; deeper undercut under the heel. Improved thread contact reduces breakage. New wear-resistant carbides add life.

TIMKEN *REMOVABLE ROCK BITS*

TRADE-MARK REG. U. S. PAT. OFF.

ONLY THE Lee-Norse MINER gives you



"PATTERN CUTTING"

The Lee-Norse Miner cuts a "DIAMOND PATTERN" in the face of the coal by simply revolving and oscillating the cutters at the same time. This is sometimes called "milling the coal off the face."

Every single Cutter Bit follows a right and a left spiral thread which produces the multiple criss-cross kerfs in the face of the coal. The diamond pattern is unique and very *important* because:

1. It cuts more coal with less power.
2. It produces coarse cuttings and less fines.
3. It is a simple and rugged mechanical device.
4. It instantly follows any variation in the thickness of the coal seam.
5. It is the ONLY REALLY NEW cutting tool introduced in recent years.

The Lee-Norse Miner is essentially a modern loading machine plus the most practical device for cutting coal. The Lee-Norse Miner loads all the coal from the floor with improved "dual" gathering arms and a flexible rear conveyor. Excellent clean-up . . . fast tramming.

Lee-Norse Company

CHARLEROI, PA.

MARCH, 1957

VOLUME 43 • NUMBER 3

Mining

CONGRESS JOURNAL

CONTENTS

Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign, $5.00. Single copies, $0.30. February Annual Review Issue, $1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Indexed regularly by Engineering Index, Inc.

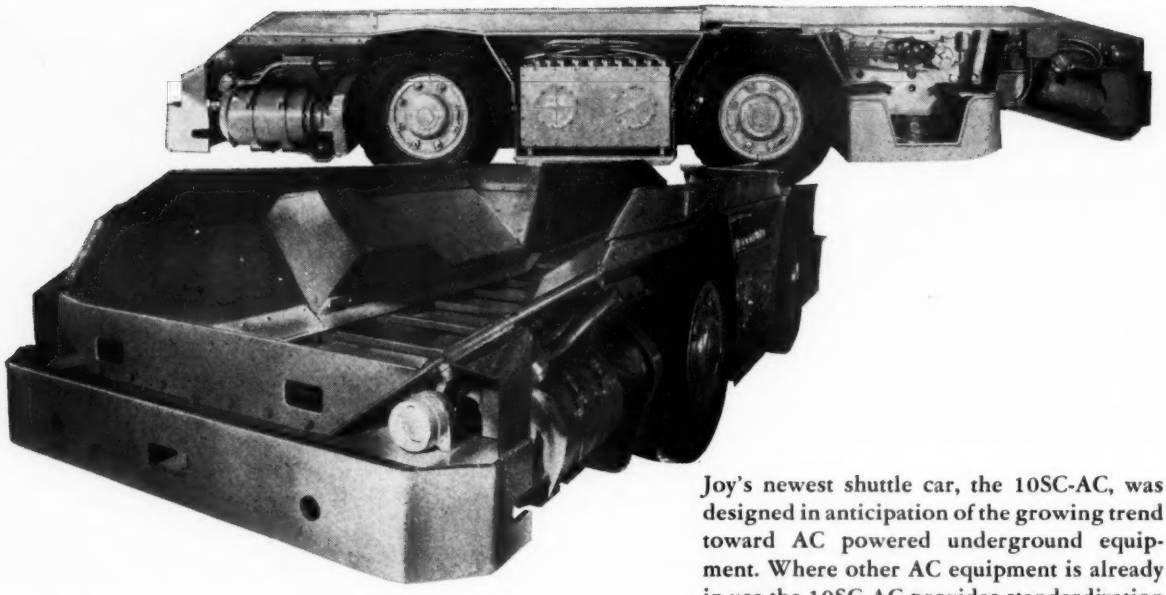
Opinions expressed by authors within these pages are their own and do not necessarily represent those of the American Mining Congress

THE AMERICAN MINING CONGRESS
RING BLDG., WASHINGTON 6, D. C.

A NEW SHUTTLE CAR

the JOY 10SC-AC

IN OPERATION SINCE MID '56



Joy's newest shuttle car, the 10SC-AC, was designed in anticipation of the growing trend toward AC powered underground equipment. Where other AC equipment is already in use the 10SC-AC provides standardization of power supplies throughout the mine ... . makes stocking and purchasing problems simpler. But more important, the 10SC-AC brings the powerful performance and extremely low maintenance of AC motors into the shuttle car field for the first time.

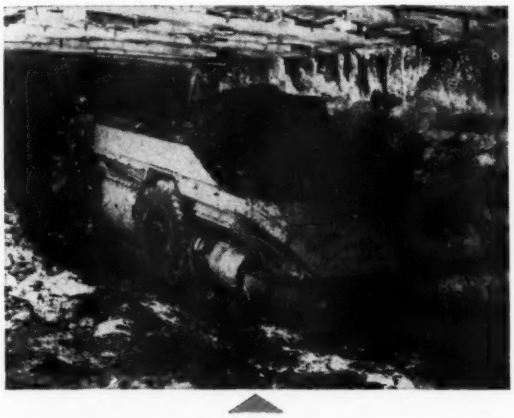
Two constant-horsepower, 2-speed traction motors, rated at 25 horsepower each, drive the car . . . eliminating all clutches, transmissions, and cross-drive shafts. Shifting is done automatically, electrically . . . fewer mechanical parts . . . less maintenance. Two constant-torque, 2-speed conveyor motors, 10 horsepower each, power the conveyor by direct drive without complicated transmission systems or complex gearing. These design features closely follow the proved design of Joy's DC driven car, the 10-SC, operating in the field for almost ten years.

4-wheel drive and 4-wheel steering makes the 10SC-AC extremely maneuverable in closely timbered areas.

See it at the COAL SHOW

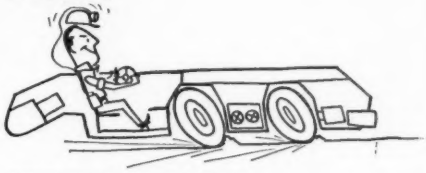
WSW CL 6419-144

operating on ALTERNATING CURRENT

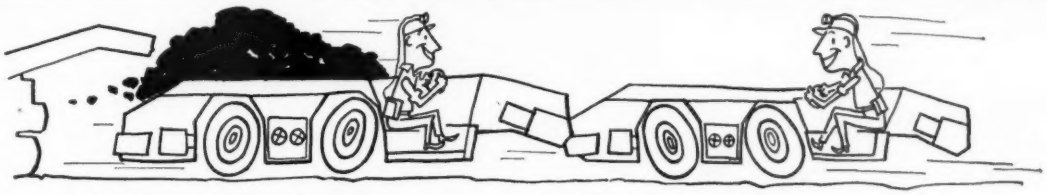


The Joy 10SC-AC car easily carries 10 tons of material even on rough bottoms.

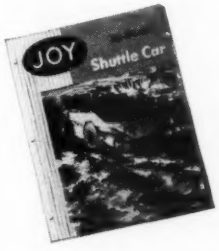
LESS MAINTENANCE—Alternating current motors are trouble free—no servicing of brushes, brush holders and studs . . . not even hand holes on the motors.



REGENERATIVE BRAKING—Standard equipment on the 10SC-AC. On down-grade, braking automatically occurs when motors are driven over their synchronous speeds.



SAME SPEED LOADED OR EMPTY—AC motors power the 10SC-AC at almost the same speed whether loaded or empty . . . keeps several cars on an even cycle . . . eliminates jams and waiting at loading point.



WRITE FOR BULLETIN 144-3

A complete description of the 10SC-AC including dimension drawings, specifications and performance curves.

PROVED PERFORMANCE—The basic design of the car is the Joy 10-SC . . . in the field since 1948. New 10SC-AC's are now working coal.

JOY MANUFACTURING COMPANY, OLIVER BLDG., PITTSBURGH, PA.

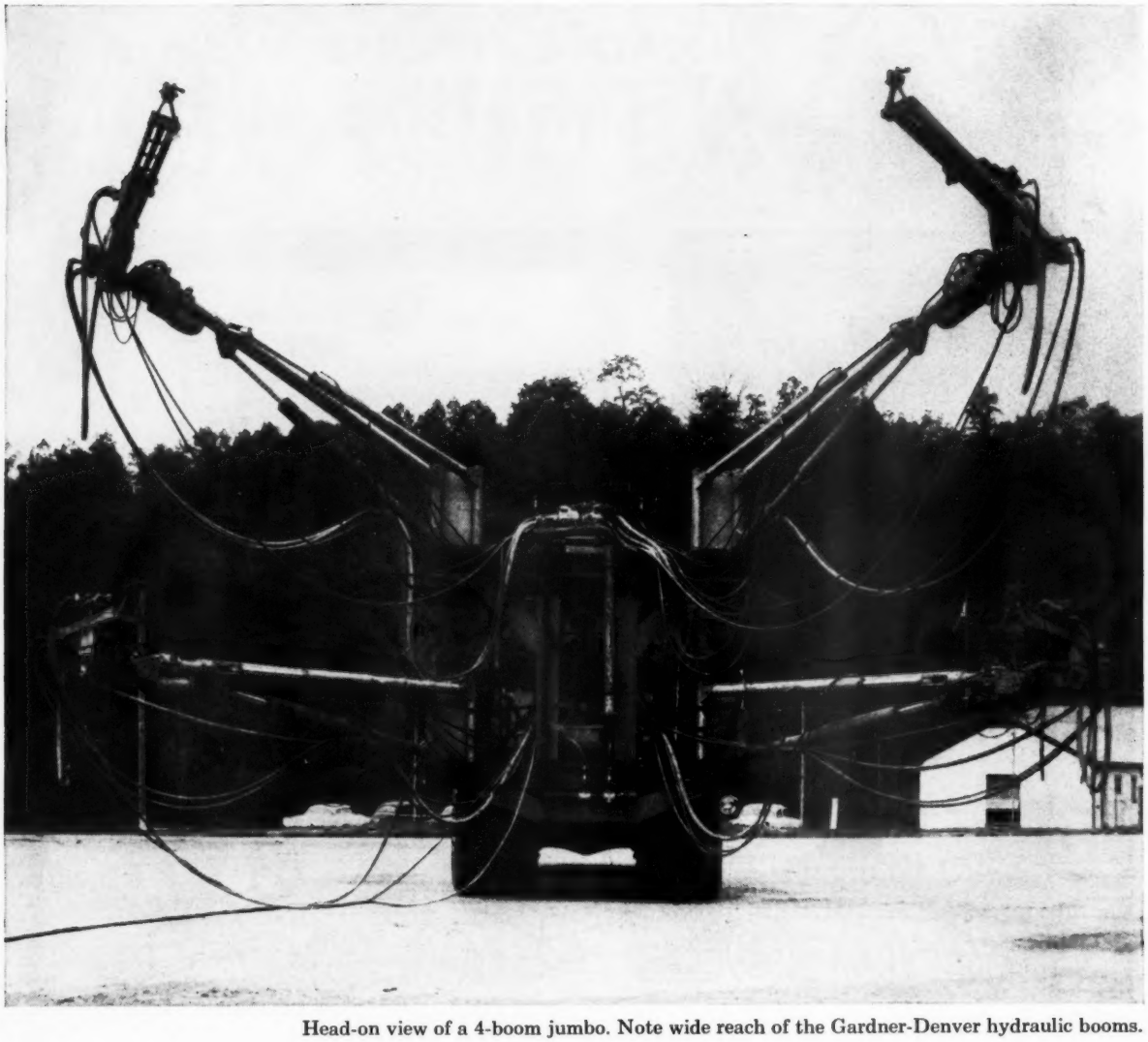
EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

CONTINUOUS MINERS

COAL LOADERS

COAL DRILLS

COAL CUTTERS



Head-on view of a 4-boom jumbo. Note wide reach of the Gardner-Denver hydraulic booms.

Build your own jumbo with
GARDNER-DENVER COMPONENTS

Tailor your truck, tractor or rail mounted jumbo with Gardner-Denver booms, feeds and drills. You get just what you need for each dollar invested. Gardner-Denver offers a wide selection in:

- **HYDRAULIC BOOMS,** completely automatic and remotely controlled for mounting on your jumbo.
- Manufactured in two sizes and types (tunnel and rugged types), TRIPODS for mounting heavier drifter equipment with the longer chain feed.
- **POWERFUL ROCK DRILLS** in 3-, 3½- and 4½-inch sizes. Long chain or screw feed mountings.
- **SECTIONAL DRILL RODS** and couplings for long-hole drilling. Gardner-Denver Ring Seal Shank.
- **REMOTE CONTROLS** located at any point along the boom or on the jumbo chassis. With G-D Remote Controls, one operator moves booms into position and controls complete drilling operation without leaving his station.

Gardner-Denver engineers will work with your staff and powderman to design your jumbo to the job.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Company, Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

HD-21 crawler tractor, 204 net engine hp
315 scraper, 20 yd heaped, 15 struck

YOU CAN STRIP OVERBURDEN AND RECLAIM LAND PROFITABLY

with this crawler tractor-scraper team

There is a marked trend toward reclaiming worked-out pits—and a parallel trend toward the use of Allis-Chalmers crawler tractors and scrapers. Both are examples of wise management.

Land Reclamation—already a law in many states—eliminates to a large extent the scarred and worthless landscapes left by abandoned pits and piles of overburden. Properly reclaimed land usually returns far more than the cost of reclamation in higher resale value. Even where pits can be only partially filled, the land may be seeded profitably for pasture.

Allis-Chalmers HD-21 Crawler Tractor and 315 Scraper are ideal for this type of operation. This team is mobile and flexible enough to strip overburden and spread it immediately in a worked-out area of the pit. This eliminates the need of re-handling overburden and of calling in specialized equipment.

Curved and offset cutting edge on the scraper, plus torque converter drive on the tractor, are just two of many features that put this Allis-Chalmers team in a class by itself for this type of work. Let your Allis Chalmers construction machinery dealer give you the details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

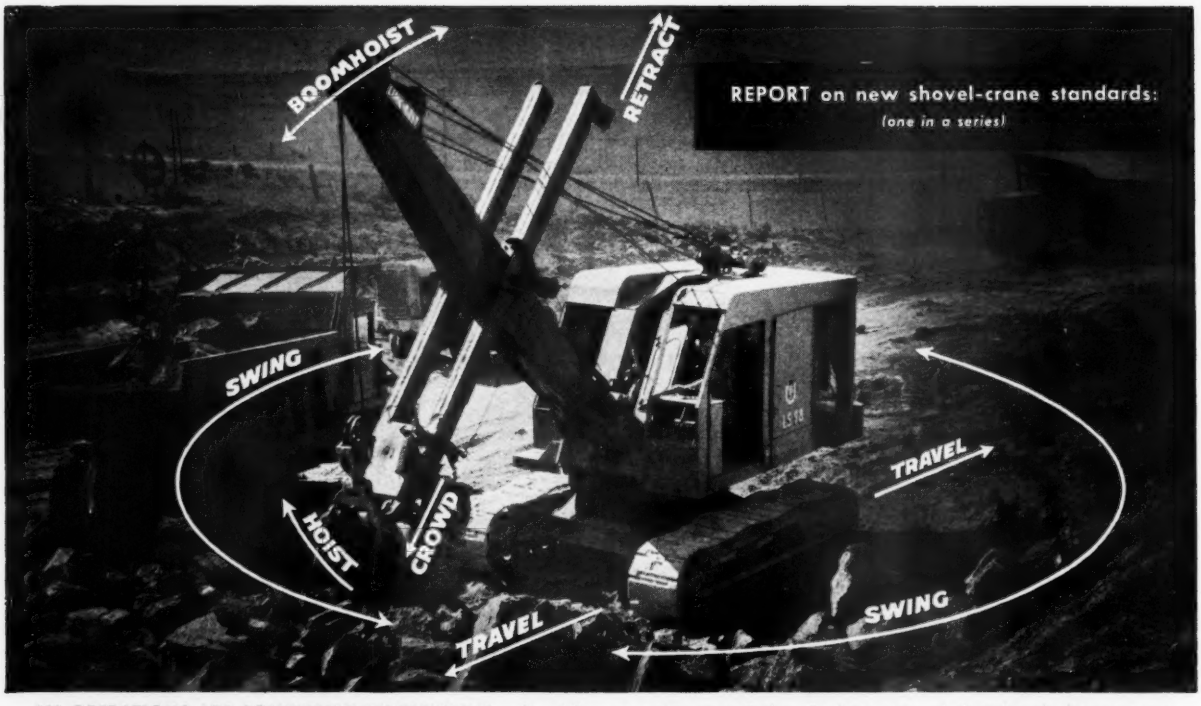
ALLIS-CHALMERS *Engineering in Action*

Roebling Royal Blue Wire Rope will **bend** and **bend** and **bend!**

What's more, Roebling Royal Blue is *stronger* than the strongest wire rope previously available. It will do more work and last longer on *your* job. Call your distributor or your nearest Roebling office for full information about Royal Blue, the really better wire rope. John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Distributors, Branches and Warehouses Throughout the Country—Subsidiary of The Colorado Fuel and Iron Corporation



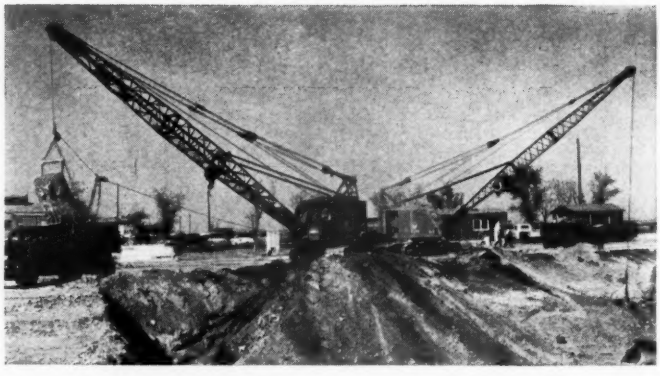
ALL OPERATIONS ARE COMPLETELY INDEPENDENT — In addition to eliminating shifting time, *Independent-Travel* allows the operator to swing and hoist the load while travelling. Whether to save time or to jockey the boom around obstacles, the operator can swing the boom while his machine is travelling in either direction. This optional feature can be used with any front-end attachment.

Getting 9 hours' output in 8

Independent-Swing-and-Travel is available on 11 Link-Belt Speeder models. Eliminates shifting . . . saves 20-30 seconds each move

Link-Belt Speeder users are setting new high-production standards by equipping their machines with *Independent-Swing-and-Travel.* Why? It eliminates time losses ordinarily occurring when the operator shifts from swing to travel and from travel to swing. With *Independent-Travel* shifts are eliminated and the machine can swing and travel simultaneously . . . you can jockey the boom around obstacles in tight quarters, move away from bank cave-ins in split seconds!

If you'd like complete details, proof that *Independent-Travel* can up output . . . cut maintenance and spare parts costs, too — see your Link-Belt Speeder distributor or write Link-Belt Speeder Corporation, Cedar Rapids, Iowa.



MORE USABLE HORSEPOWER — Size for size, Link-Belt Speeder shovel-cranes utilize more of the engines' available horsepower. This bonus pays off in added power at the bucket teeth, greater line pull plus extra power to swing, hoist and travel. Although it gets more usable power and line pull out of the same engines used in other shovel-cranes, a Link-Belt Speeder remains well within the engine manufacturers' recommended operating speeds.

14,324

It's time to compare . . . with

LINK-BELT SPEEDER

Builders of a complete line of shovel-cranes . . . with exclusive Speed-o-Matic power hydraulic controls

DIAMETER OF CAN OR CARTRIDGE	LOADING DENSITY: POUNDS PER FOOT OF BOREHOLE		
	SPECIAL GELATIN 75%	"NITRAMEX" NO. 2	"NITRAMEX" 2H
4½	9.6	11.0	12.5
5	11.8	14.5	15.8
5½	14.2	17.5	19.3
6	17.0	20.8	22.5
6½	19.9	24.5	26.5
7	23.1	28.0	30.8
7½	26.5	32.5	35.3
8	30.2	37.0	40.0
8½	34.0	41.3	45.0
9	38.2	45.3	49.0

Now A New Hard-Hitting Blasting Agent, for tough shooting... better breakage

DuPont Heavy "Nitramex®" No. 2H*

For open pit shooting where tough bottoms and formations have proved hard to overcome, Du Pont now offers a higher density "Nitramex" No. 2, called "Nitramex" No. 2H.

In field tests this new product has produced noticeably better breakage in such tough shooting material as taconite, magnetite, massive sandstone and hard, dense dolomite. Because it also has infinite water resistance, it may be loaded in wet holes as long as necessary before shooting.

The new heavy "Nitramex" No. 2H has a density of 1.80 compared to 1.60 to 1.65 for regular Du Pont "Nitramex" No. 2. The smallest size currently available (4½" x 24") weighs 25 pounds compared to 22 pounds for the regular "Nitramex" No. 2. "Nitramex" No. 2H can be consistently detonated with maximum safety by either a "Nitramon" or a "Nitramite" primer.

For technical information on this newest, strongest member of the Du Pont family of blasting agents, contact your Du Pont Explosives representative or write E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Del.

*PATENT APPLIED FOR

DU PONT BLASTING AGENTS

Products of Du Pont Research

DU PONT

REG. U.S. PAT. OFF.

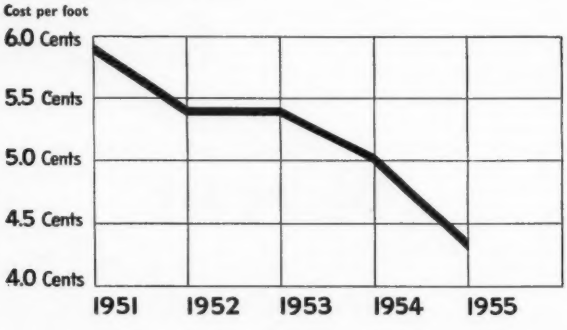
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

ONE BILLION FEET DRILLED EACH YEAR WITH THESE STEELS

For many years Sandvik Coromant steels have been the world's most widely-used integral drill steels. And as each year passes, their share of the world rock-drilling market becomes even larger; responsible for drilling more than one billion feet annually. The reason behind this ever-increasing demand is their consistently high and uniform quality.

Meticulous production control

Sandvik control every phase of production, from the mining of iron ore and processing of the wolfram ore, to the final tungsten-carbide-tipped drill steels. This 'under-one-roof' policy of Sandvik has produced steels of a quality that is always improving; steels that have brought *faster* speeds and *new* economies to drilling. The production of Sandvik Coromant steels is not only strictly controlled, but also influenced by valuable information gained from extensive research. Every year, with the close co-operation of Atlas Copco, hundreds of miles of test drilling is carried out both in Sandvik's own test mine and under actual working conditions.



Increased quality brings lower drilling costs

Since the introduction of Sandvik Coromant steels some ten years ago, their quality and life has been continually increased. A longer life means *lower* drilling costs. For example, take the costs of a well-known Canadian mine shown in the graph. You'll notice that the cost per foot with Sandvik Coromant steels has decreased by 25 % in just four years!

World's leading drilling unit

Sandvik Coromant drill steels are another step towards lower drilling costs. And when fitted to an Atlas Copco rock drill you have an unbeatable drilling unit, for both were developed to work together. *No drill or steel developed separately could ever give such equivalently high performances.* Atlas Copco drills and Sandvik Coromant steels have become the world's leading drilling unit, a combination that has turned mining and tunnelling—in just one decade—into a smooth and highly-efficient operation.

SANDVIK COROMANT integral steels, detachable bits and long-hole equipment are supplied in ninety countries throughout the world by Atlas Copco, who, in their own field, are the world's largest manufacturers of rock drills. Contact any of these offices *today* for further information and a demonstration.

U.S. Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California. Atlas Copco Eastern, Inc., P.O. Box 2568, Patterson 25, N.J.

CANADA Atlas Copco Canada Ltd., Montreal Airport, P.Q.

MEXICO Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.

Atlas Copco

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

Continuous Loading with LONG Equipment at Elkhorn No. 3 Mine, Island Creek Coal Co.

Tons per man-shift increased 183% with LONG Piggyback Systems

At Island Creek Coal Company's Elkhorn No. 3 Mine, Evanston, Ky., extremely adverse mining conditions are encountered. The seam averages only 30 inches in height and roof conditions dictate the use of low-height equipment which permits extensive timbering and a rigid system of roof control.

During the first four years of the mine's operation, several methods of mechanized-loading mining were utilized, but with only limited success. In early 1954, when increases in productivity were imperative, a LONG Piggyback* bridge conveyor system was installed in one section. This first unit—consisting of a Pigloader* loading machine, Piggyback bridge conveyor, and LONG chain room conveyors—was so successful that seven additional systems were purchased and put into operation. The result—by late 1956, face productivity was increased by 183% (as reported in a recent issue of a leading trade journal).

Whatever your *operation conditions—either thick or thin seams—the Piggyback System of conveyor mining will boost your production and lower your costs. We'll be glad to supply facts and figures—without obligation.*

**Trade Marks Reg. U. S. Pat. Office*

For complete details or a demonstration, write . . .

The LONG Company
OAK HILL W VA

Owners know that every Allis-Chalmers engine is backed by the company's long reputation for building engines that are *tops* in dependability and economy — engines totaling hundreds of thousands of horsepower.

Operators like the continuous-duty rugged power, the reserve built into their Allis-Chalmers engines. As loads increase, these high-torque engines lug right through.

They ALL Like Allis-Chalmers Engines . . .

Mechanics find there are less parts — that they are simple, easily accessible, require fewer adjustments. Maintenance time is reduced to a minimum.

Everyone likes the Allis-Chalmers *3-deep* service from the dealers, the 18 branches and the factories.

For more reasons why "they all like Allis-Chalmers engines," see your Allis-Chalmers engine dealer, or write for detailed information.

ALLIS-CHALMERS, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

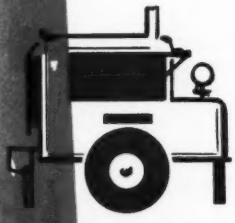
BE-10A

An Allis-Chalmers 8DAS 1125 supercharged diesel powers this truck, and a 6DCS-1879 supercharged diesel powers the shovel at the Bagdad Copper Corp. mine. Allis-Chalmers diesel engines in 24 Dart and Euclid trucks help keep production flowing smoothly under extremely demanding conditions at the mine. These big, tough engines also are used here on drills, compressors and dozers.

Got a tough job?

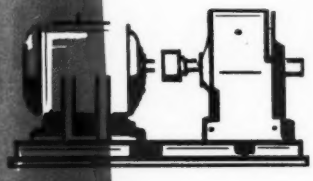
Give it to STANOIL Industrial Oil

This oil gives superior lubrication to a long list of mine equipment—here are three big jobs it can do—



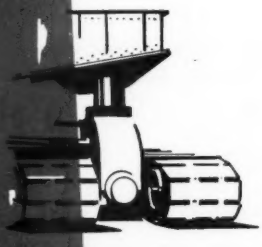
COMPRESSOR

High oxidation stability and low carbon-forming characteristics of STANOIL virtually eliminate the danger of carbon deposits on valves. STANOIL separates readily from water. There is no problem of emulsion in compressor crankcase.



SPEED REDUCER

There are many years between maintenance jobs on speed reducers when STANOIL is the lubricant. Herringbone gears remain clean and free of wear. Low pour point of STANOIL gives oil ability to flow freely from a cold start. No trouble either in prolonged, high temperature operation.



HYDRAULIC JACKS

Tough mine hydraulic service is the ideal place for STANOIL. High viscosity index and low pour point of STANOIL assure smooth operation no matter what the temperature. STANOIL resists contamination, will not emulsify.

Pick your tough lubrication jobs, give them to STANOIL Industrial Oil and get the results you have wanted. Find out more. Call your Standard Oil industrial lubrication specialist. There is one near you in any of the 15 Midwest and Rocky Mountain states. He is experienced in mine lubrication. Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

Quick Facts About

STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—Inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm-ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, is resistant to temperature change.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

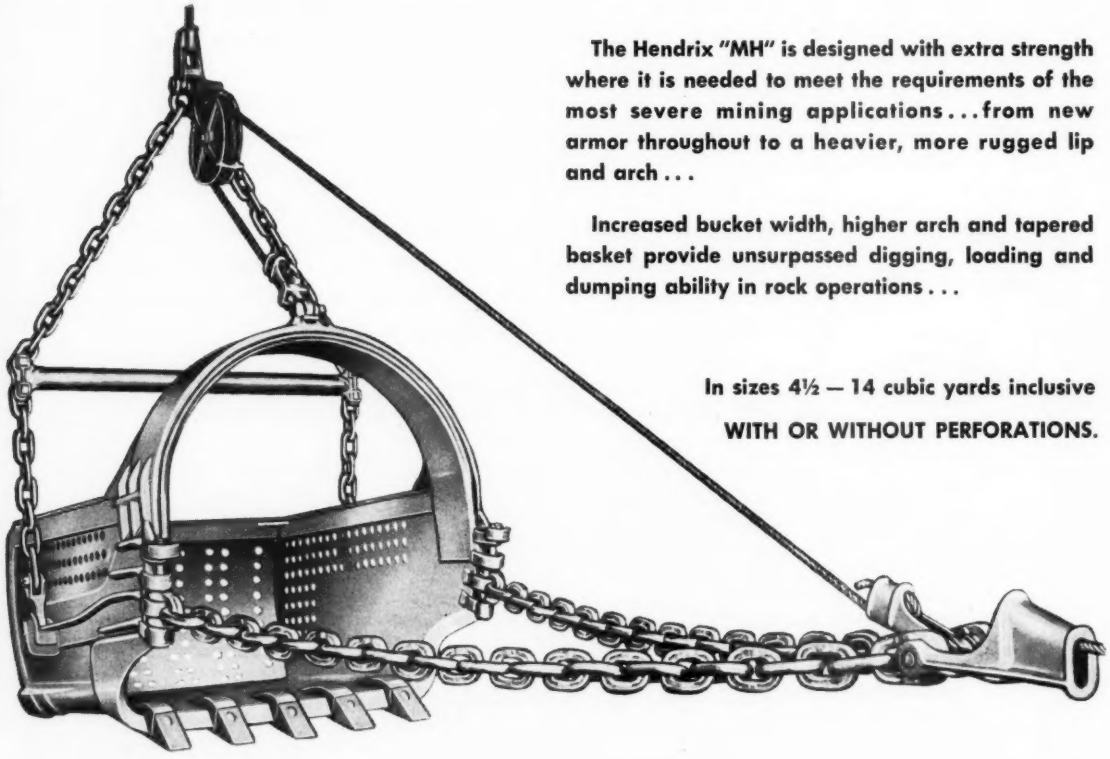
STANDARD OIL COMPANY
(Indiana)

STANDARD

Advanced-design features of...

the new HENDRIX "MH" Heavy Duty Mining Bucket

KEEP PRODUCTION UP ...and COSTS DOWN



The Hendrix "MH" is designed with extra strength where it is needed to meet the requirements of the most severe mining applications...from new armor throughout to a heavier, more rugged lip and arch...

Increased bucket width, higher arch and tapered basket provide unsurpassed digging, loading and dumping ability in rock operations...

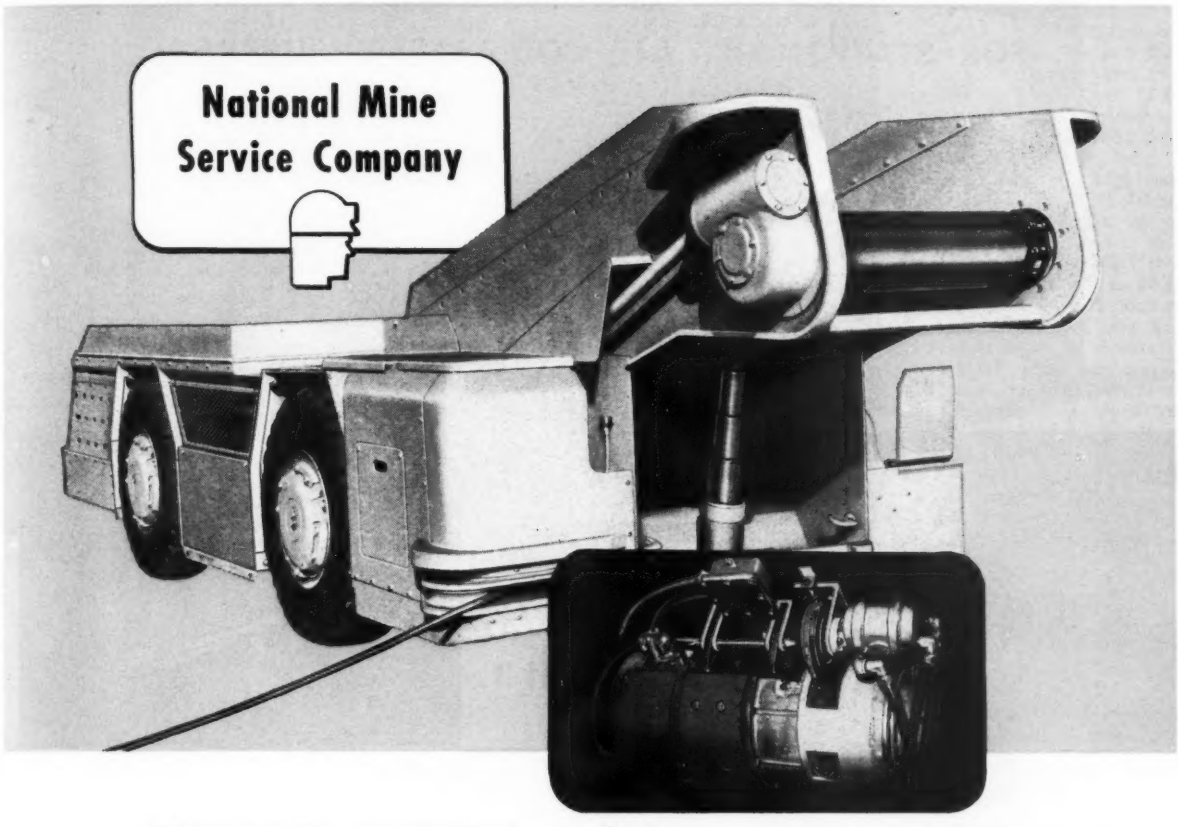
In sizes 4½ — 14 cubic yards inclusive

WITH OR WITHOUT PERFORATIONS.

HENDRIX MANUFACTURING COMPANY, Inc.

MANSFIELD, LOUISIANA

Hendrix Lightweight DRAGLINE BUCKETS



The single-motor design of the new National Mine TORKAR* A.C. or D.C. shuttle car is a major factor in reducing maintenance and operating costs

Electrical controls and wiring are greatly simplified because one, *single*, large capacity, non-reversing, A.C. or D.C. motor supplies all power for the new TorKar.

Driving through a torque converter, the motor operates at its most efficient speed, with less frequent starts and stops, and for much of the time under less than its full-load capacity. Ample opportunity is afforded for dissipation of heat. Power demand is less, and longer service life and lower maintenance cost are assured.

The torque converter absorbs and minimizes torsional shock of the drive line to the motor, and multiplies motor torque in varying amounts to meet demand. It also prevents the motor from being overloaded to the point where it might approach a stalled condition, thus inviting thermal damage.

Further reduction of load demand on the motor is accomplished by the constant-mesh, three-speed forward and reverse, patented transmission which makes it possible easily and quickly to select a gear ratio which will allow continuous movement of the car without jogging the motor or pulling its speed down to a point where it would operate inefficiently.

To learn in more detail how the TorKar can cut your maintenance and operating costs with these and other exclusive engineering and design features, write for literature or ask your National Mine representative to call.

*Trademark

U. S. Bureau of Mines Approved

National Mine Service Company

564 Alcoa Building • Pittsburgh 19, Pennsylvania

All-State Division
Logan, W. Va.

Anthracite Division
Forty Fort, Pa.

Ashland Division
Ashland, Ky.

Bemeco Division
Beckley, W. Va.

Kentucky-Virginia Division
Jenkins, Ky.

Western Kentucky Division
Madisonville, Ky.

Whiteman Division
Indiana, Pa. Morgantown, W. Va.

One of the nation's major sources of titanium, this open-pit has produced 15,000,000 tons of ilmenite-magnetite ore and 8,700,000 tons of concentrates since its start in 1942. Over 17,000,000 tons of rocky overburden have also been removed. Entire deposit is 1800 ft. long, 900 ft. wide; averages 35% magnetite, 32% ilmenite, 10% feldspar and 23% iron silicates. All ore and waste must be shot...drill holes are sunk with a 42-T churn drill using a 9 inch bit, to 39 ft. deep. From 350 to 500 lbs. of 90% gelatin dynamite are used per hole...each lb. breaks up 3½ tons of waste and ore. A 4-yd. shovel, together with four 22-ton rear-dump trucks, loads all waste ...two 2½-yd. shovels, together with seven 15-ton trucks, move the ore. Finished ilmenite goes to processing plants, for conversion into titanium dioxide pigments for paints, paper, rubber, ceramics, and other substances. Magnetite concentrate is both converted to sinter and shipped raw to various iron, steel, refractory, and cement plants.

How rubber-tired tractors cut costs for one of world's largest titanium mines

In the heart of the Adirondack Mountains in upper New York State lies a mine which is one of the world's largest producers of titanium. From a pit 900 ft. x 1,800 ft. comes 3,200,000 tons of ore and waste yearly. Two rubber-tired Tournatractors shuttle back and forth to handle tractor work at pit, stockpiles and plant.

1 tractor cleans around 3 shovels, 1 dropball, 11 trucks

One of these 17 mph 208 hp units is assigned mainly to pit and dump clean-up. At the pit, it cleans around *two* 2½-yd. shovels, *seven* ore-hauling trucks, *one* 4-yd. shovel, *and* a rubber-tired dropball crane. At the dump, a mile away, it cleans up for a fleet of 4 end-dump trucks. Rig shuttles continuously between assignments. A 300 ft. trip between shovels takes as little as 20 seconds ...the mile from pit to dump takes 3 to 5 minutes. Despite this busy schedule, tractor finds time to move air compressors, drills, and other pieces of pit equipment.

Another dozes magnetite weighing 4800 lb./yd.

The second Tournatractor is used primarily on the magnetite stockpile. Here it dozes concentrate within range of clamshell that loads railroad cars, or else dozes directly into a hopper. Rig's blade often carries 2½ cubic yards of material — weight *6 tons!* When needed, this tractor moves to other stockpiles to doze ilmenite concentrate or coal. Occasionally, it spots railroad cars in the sintering plant area. As needed, it cleans spillage from roads and haulage ways, and does other odd jobs. Wherever it goes, rig's low-pressure tires do no damage to footing. They roll easily over pavement, railroad tracks and ties.

Each costs $1 less per hour to operate than crawler-tractors

On shovel clean-up jobs, owners report Tournatractors outproduce the biggest crawler-tractors, 2-to-1. Units usually work at higher speeds and move job-to-job at higher speeds. Tournatractors cost less to maintain, too...4 tires eliminate the headaches of 500 to 600 track parts. Lowered maintenance, plus lower repair and operating costs are proved by accurate figures kept by the mining company. These show cost to operate Tournatractor "averages" approximately *$1.00 less per hour than their records of average cost for crawler-tractors.*

You judge its advantages

Tournatractor's lower costs, "go-anywhere" mobility, and fast-working speeds can pay off for you, too! Ask your LeTourneau-Westinghouse Distributor for a demonstration of this versatile machine so you can judge its advantages for yourself!

Tournatractor—Trademark Reg. U.S. Pat. Off.
T-752-M-bw

▼ Dozing stockpiled magnetite, Tournatractor moves up to 2½ bank yards (about 6 tons) per push.

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

Front view of the Jeffrey Colmol at Enoco Collieries, Vincennes, Indiana, shows Kennametal Taper-Shank Bits in the outer position holders.

New Kennametal* Taper-Shank Bits pay dividends at Enoco Collieries

THE PROBLEM: Enoco experienced rather high bit costs on Colmol mining the tough Indiana #5 Seam. The bits in the outer holder positions on the Colmol arms were largely responsible. It is in these positions that bit velocity is greatest and bit punishment most severe. How to cut bit costs and maintain high production?

THE SOLUTION: The cooperative efforts of Enoco, Jeffrey Mfg. Co., Cincinnati Mine Machinery Co., and Kennametal Inc. led to the development of special bit holders and the Kennametal Taper-Shank Bit. These were put in service on the outer positions.

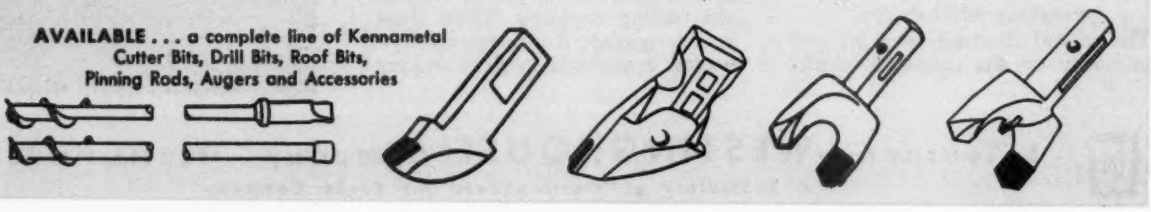
THE RESULTS: Bit costs were reduced 66%. Coal production continues at even higher levels. Bracket trouble has been reduced at least 90%, according to John Stachura, General Superintendent. The 50% reduction in bit changing time provides added valuable production. Bit changing is so easy that Colmol operators keep sharp bits in the machine.

If you have a similar problem, Kennametal Taper-Shank Bits may provide the solution. A Kennametal representative will gladly demonstrate them. He is located near you. Or write KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania.

*Trademark

C-3018

AVAILABLE . . . a complete line of Kennametal Cutter Bits, Drill Bits, Roof Bits, Pinning Rods, Augers and Accessories



Kennametal Style U7T
Taper-Shank Cutter Bit

and they provide these advantages wherever full-face continuous miners are utilized

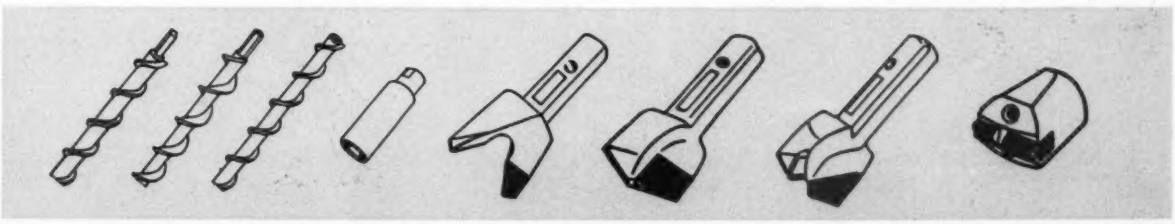
Kennametal Taper-Shank Cutter Bits are easy to install. (Conventional holders are shown on inner positions.)

Benefits provided by Kennametal Taper-Shank Bits result from several unique features of these bits. The taper-shank and bit block have full contact throughout the length of the bit shank, holding bits more firmly and accurately. This eliminates tendency of bits to wobble and increases service life of both bits and block. Furthermore, the bits cut more accurate and consistent clearances. The taper automatically sets the bit gage. Changing bits requires less than half the time required for changing bits with conventional setscrew type holders.

In addition, Kennametal Taper-Shank Bits have many of the features of other Kennametal Cutting Bits: high quality carbide grades; I-beam construction for additional strength and cutting clearance; thinner web with less steel to grind; top angle for effective control of cutting flow; and ample support for the carbide.

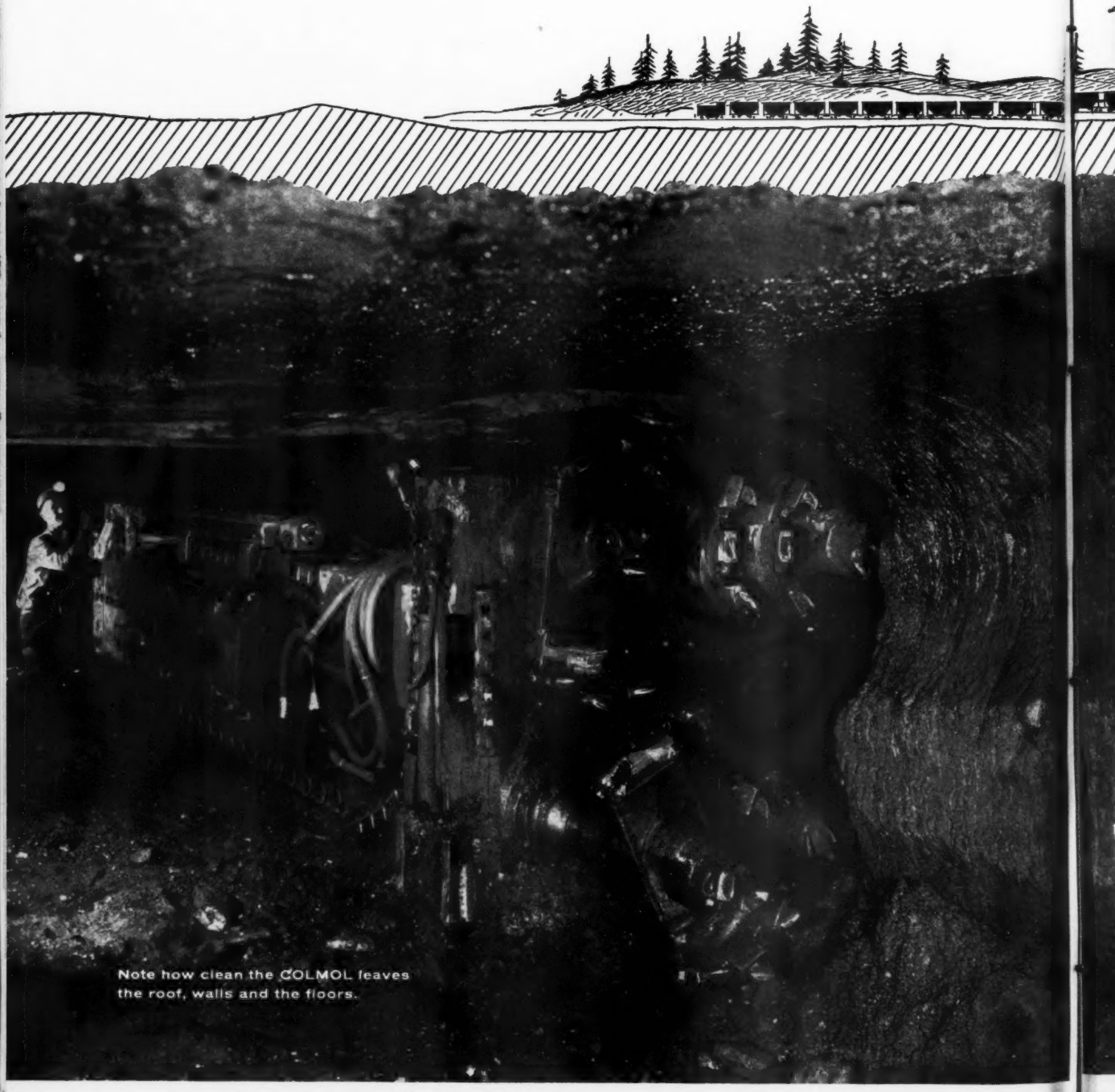
Changing bits is also easy with a drift wedge at knock-out shoulder or bottom of shank.

INDUSTRY AND
KENNAMETAL
...Partners in Progress



For high tonnage production...

the JEFFREY COLMOL®



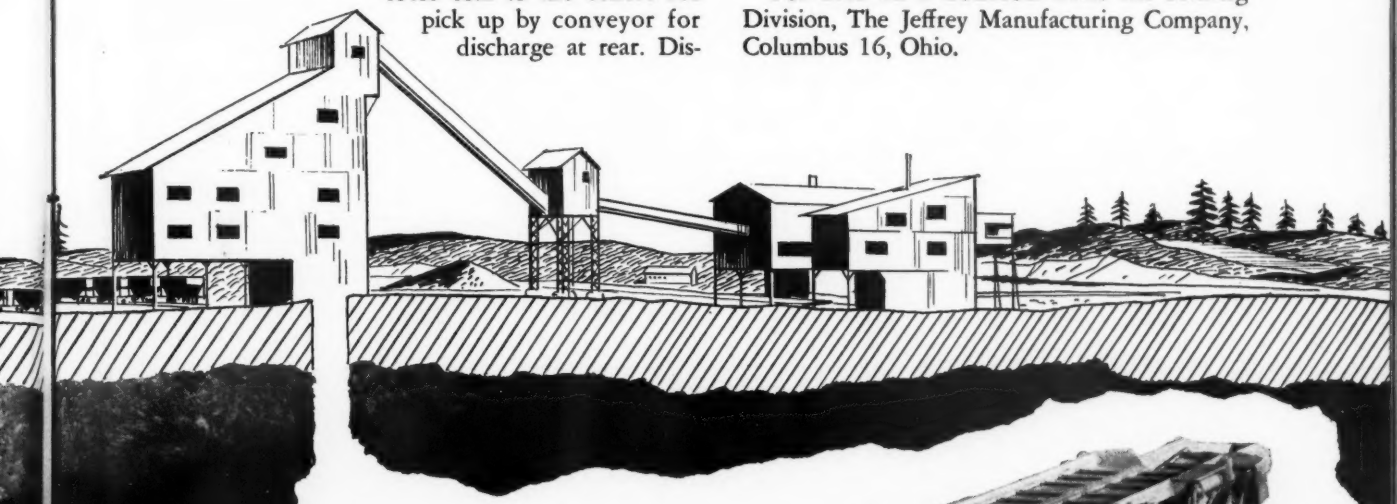
Note how clean the COLMOL leaves the roof, walls and the floors.

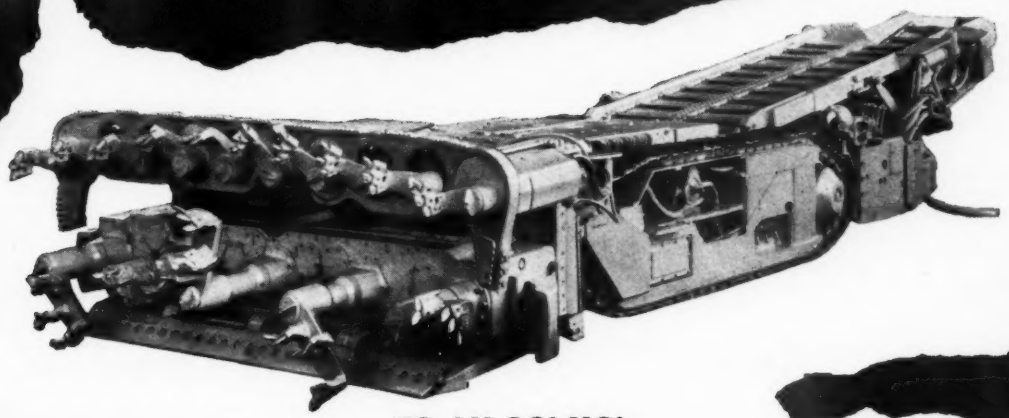
● As a powerful Jeffrey COLMOL Continuous Mining Machine advances into a seam, it brings down coal in an area 9′ 8″ wide times seam height . . . with little noise, vibration, or dust.

With head raised, lowered or tilted to follow seam irregularities, revolving cutters break off coal of a screen consist comparable in most seams to conventional mining. Arms sweep loose coal to the center for pick up by conveyor for discharge at rear. Discharge conveyor swings 31 degrees for easy loading. Hydraulic control assures instant and accurate adjustments.

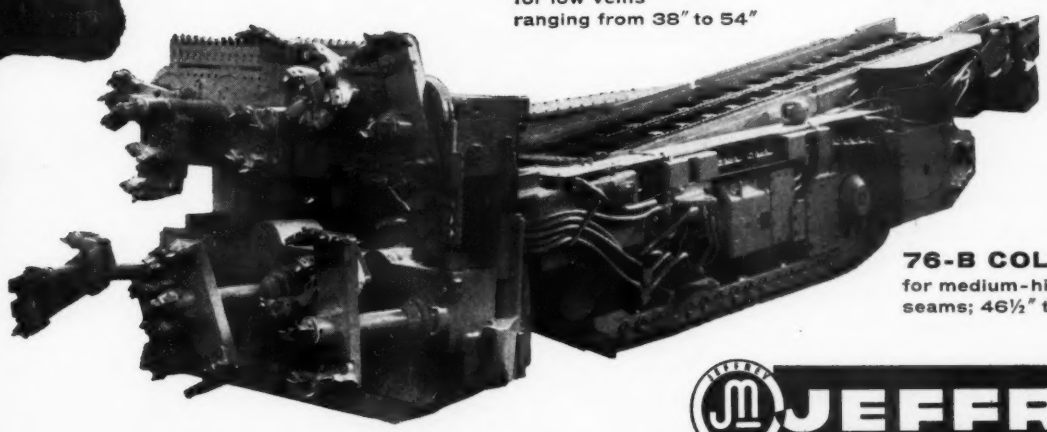
Rugged construction cuts downtime. Operating parts are accessible for servicing and adjustment. Centralized controls once set, need little attention, thus reducing operator fatigue. Operator works in safety 20 feet from the face.

For data on a COLMOL write the Mining Division, The Jeffrey Manufacturing Company, Columbus 16, Ohio.





76-AM COLMOL
for low veins
ranging from 38″ to 54″



76-B COLMOL
for medium-high
seams; 46½″ to 72″

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT • TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

In Kentucky ...and the World Over

Bucyrus-Erie's Special Machines for Special Jobs

Keep Operating Costs Low

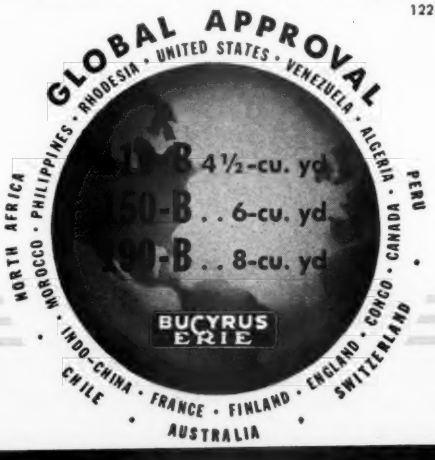
At a large mining operation near Central City, Ky., two Bucyrus-Erie 190-Bs, specially built for the work they perform, are bringing new economies to open-pit coal removal.

Coal at this location occurs in two seams separated by a 4-ft. layer of clay and limestone, which must be drilled and blasted. This layer is being removed by a 190-B stripping shovel with 70-ft. boom and 6-cu. yd. dipper. Loading out coal from one of the seams has been assigned to a special 190-B coal loader equipped with 10-cu. yd. dipper.

Like other Bucyrus-Erie Ward Leonard electric shovels, these machines have the advanced-design features that mean high-output, low-cost performance month after month. Their modern front end design and heavy duty construction offer great strength while reducing power-wasting deadweight. Ward Leonard control permits rapid acceleration and deceleration for high-speed, coordinated operation.

Let us give you the facts on the 190-B and two other models — the 4½-yd. 110-B and the 6-yd. 150-B. Write direct for full information.

122L57C



BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN

how to get the most out of HOLLOW DRILL RODS

Detachable carbide insert bits are a cost-cutting tool for the hard rock driller. But their use presents problems to the blacksmith. One problem is the premature failure of the attachment on the drill rod. When that happens, time is wasted in trying to recover the bit and, often, valuable bits are lost.

But, with new alloy steels such as Crucible CA DOUBLE DIAMOND or 4E, plus careful control of operations in the forge shop, you can keep failures to a practical minimum.

For example, prevent SCALING OF THREADED SECTION

Excess scaling may produce undersize threads, loose fitting bits and ultimate mechanical failure of the drill rod due to poor stress distribution. Here are a few precautions to take to prevent excess scaling:

TIME AND TEMPERATURE—

Of primary importance are the time and temperature which the heat-treater selects for the job. Although they will vary somewhat with the composition of the steel and the size of the rod, time and temperatures should be selected which are the minimum at which the desired result can be obtained. Excess furnace time or temperature will result in excessive scale formation.

FURNACE ATMOSPHERE – Avoid a highly oxidizing flame. The higher the excess oxygen content, the greater the tendency for scale and decarburization to form. And a reducing flame leads to carburizing brittle threads. The furnace best operates with a "soft" smoky flame or under near neutral conditions.

SCALE REMOVAL—

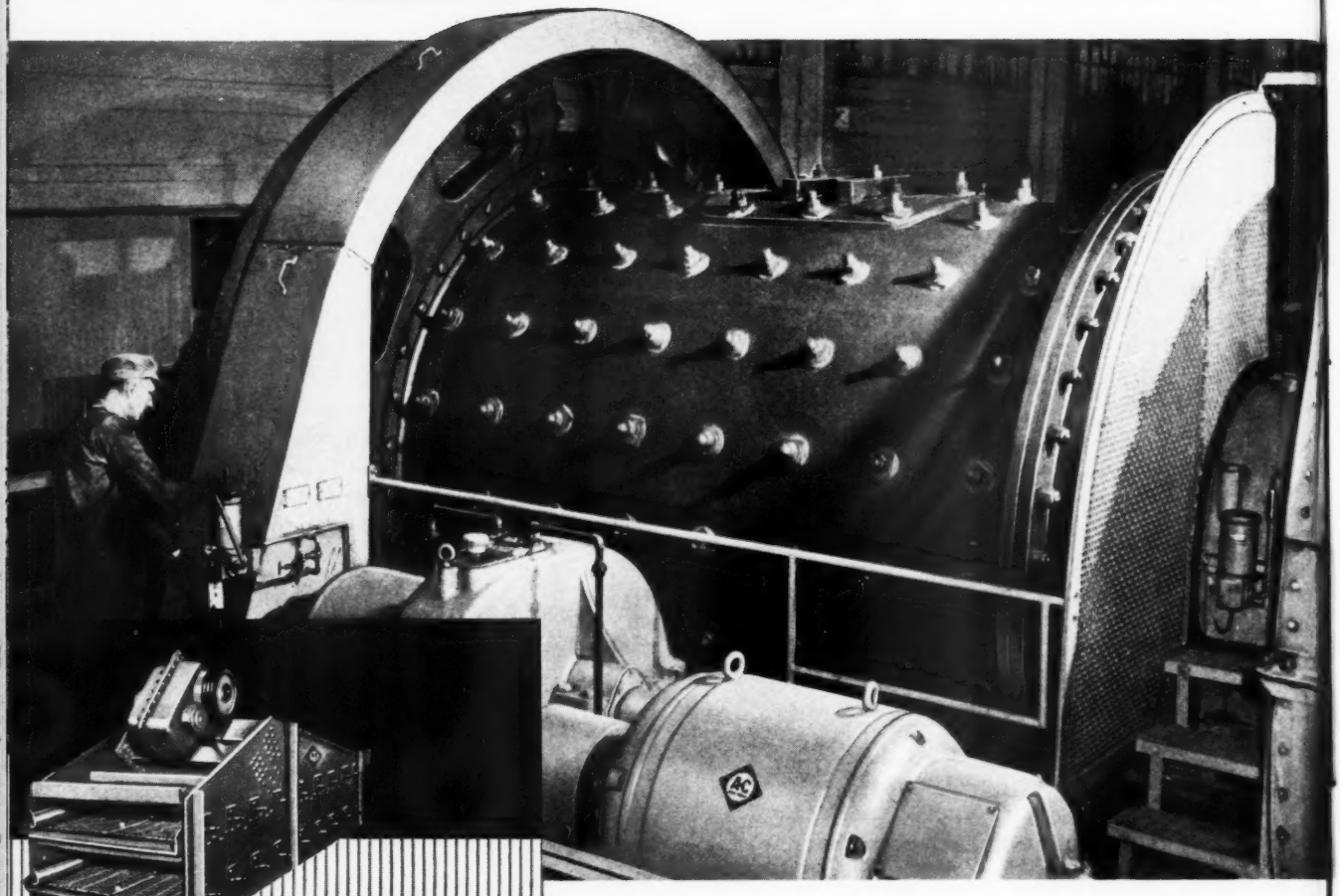
Scale is abrasive, and unless what scale does occur is removed, thread wear results. Wire brushing is a fast, convenient and safe method for removing scale.

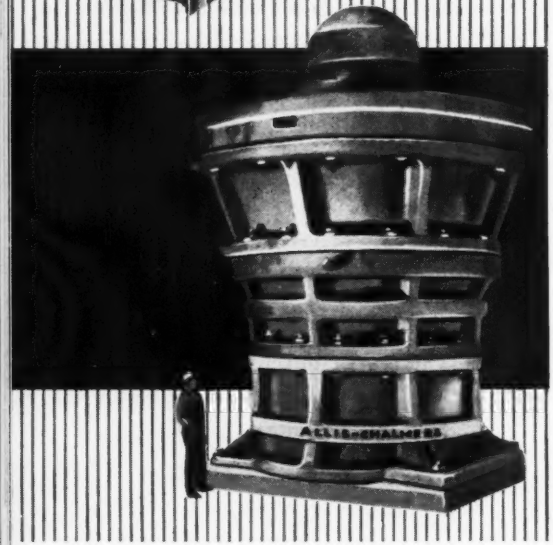
Crucible hollow drill rods are tough, strong—made to tool steel standards. Their *extra* quality means less rod breakage—fewer valuable bits lost. So specify Crucible hollow drill rods for your next job. They're quickly available in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

You Get MORE than Equipment When



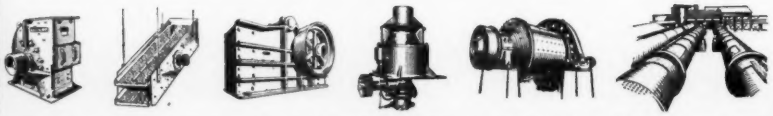


"Coordineered" Equipment for the Mining and Rock Products Industries

GRINDING MILLS—Whether your process calls for individual mills or a grouped stage grinding series, Allis-Chalmers can make a right-for-the-job recommendation from seven different types of grinding mills.

VIBRATING SCREENS—Allis-Chalmers screens are built in single and multiple-deck models for use in scalping, wet or dry sizing, washing, rinsing, dewatering, and media recovery.

GYRATORY CRUSHERS—"One-man, one-minute product control" slashes the time it takes to change crusher setting from hours to seconds. Size adjustment, compensation for wear and emergency unloading are accomplished at the flick of a switch.



ammermills • Vibrating Screens • Jaw and Gyratory Crushers • Grinding Mills • Kilns, Coolers, Dryers

ALLIS-

You Buy From ALLIS-CHALMERS

The Plus is the "Coordineered" Approach to Equipment Development and Application

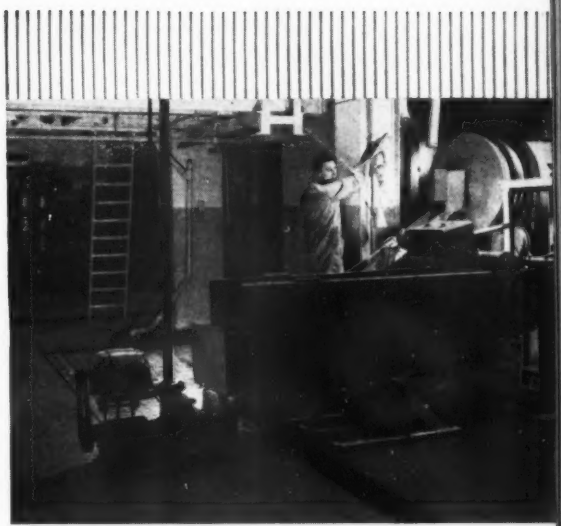
BECAUSE Allis-Chalmers makes so many types of equipment used in the mining industry, it is the *one* company that can team up its thinking, planning and engineering in designing, building and application. We call it "coordineering."

In this unique approach, your A-C team draws from a background of over a century of experience and an unparalleled concentration of field and laboratory data . . . detailed information on the processing of practically every material mined and quarried throughout the world.

Better Equipment, Better Methods, Better Results for You

The utilization of this experience and intimate knowledge of your requirements has, of course, influenced the outstanding development and advanced design of Allis-Chalmers equipment. But more than that, these factors, combined with A-C diversification, have made possible the "coordineering" of related equipment in smooth, profitable processing arrangements in plants everywhere.

For more about the "more" you get, see your Allis-Chalmers representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.



The A-C laboratory is one of the best equipped, best staffed in all industry. Information obtained in laboratory and pilot plant testing helps determine the equipment and process best suited to a given application.

This bulletin with its explanation of the "work index" formula enables you to evaluate any size reduction operation . . . compare efficiency of plants, circuits and machine. It offers the only practical approach to improving performance . . . of determining the right machine for a job. Write for Bulletin 07R7995.

CHALMERS

A-C ALLIS-CHALMERS

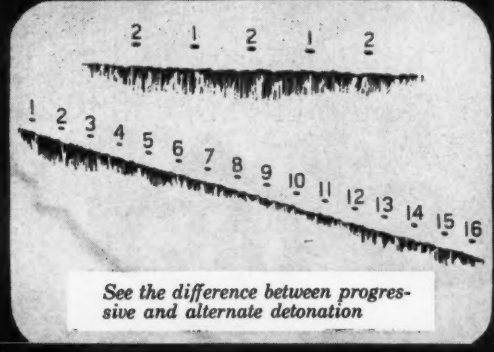
A-5114

TO HELP YOU BLAST WITH GREATER ECONOMY

The INSIDE STORY

See how modern blasting methods improve breakage

See how the point of initiation affects rock movements...controls throw



See the difference between progressive and alternate detonation

Don't miss this movie for men who use explosives in Quarries, Strippings and Construction!

Here is a motion picture that gives the facts on modern blasting techniques. It shows how you can save money through better, more complete fragmentation . . . how you can increase safety by eliminating the need for secondary blasting . . . and how your public relations can be improved by holding noise and vibration to a minimum.

"*The Inside Story*" is prepared by Atlas Powder Company as a technical service. Show it to your organization for a better understanding of scientific blasting. It explains in detail how the point of initiation affects blasting results . . . how millisecond delay techniques and alternate velocity loading are used to gain maximum efficiency.

This information also makes "*The Inside Story*" well suited for showing at institute meetings and to other engineering groups.

How to get the film. Simply write us on your letterhead, telling us at what type of meeting you'd like to show "*The Inside Story,*" and approximately when you'll need it. We'll try to ship a print to you well in advance of the date you select.

Ask also about other Atlas educational material such as the films, "*How to Handle Women and Explosives*" (for your safety meetings), and "*We're Blasting Near You*" (to show to your neighbors). And write for "*Better Blasting,*" the informative Atlas newsletter on latest blasting materials and methods.

EXPLOSIVES DIVISION

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

Moving fast, this 123 hp "550" keeps pit floor clean, blades off loose dirt and rocks. Smooth access saves wear on haulers' tires. Regular clean-up, improved drainage, prevents dirt and refuse from weathering into levels of pit floor.

9 WAYS

to increase pit output and cut cost per ton

You may think of your grader simply as a maintenance tool. But in the hands of a good operator, a versatile, modern high-speed grader actually steps up mine and quarry production, and cuts operating costs. Check these 9 big ways increased grader capacity can boost profits.

1 Regular, more frequent maintenance of haul roads—smooth roads speed hauling, save tire wear, cut hauler down-time, improve safety.

2 Quick clean-up after blast—grader provides a fast, inexpensive way to move scattered fragments back against toe—thus protecting men, machinery, tires and other equipment working around pit, speeding up all pit operations.

3 Clean pit floors—regular routine of maintaining wide, clean traffic-ways that make all areas of pit or quarry quickly accessible, pays off. Equipment can always travel to any assignment by shortest route. Regular clean-up, improved drainage, prevents dirt and refuse from weathering into ore or coal below floor.

4 Maintain good housekeeping around plant—you need ample grader capacity to keep roads, runways, working areas around plant neat, clean, and workable at all times. Grader quickly and efficiently levels or removes the occasional spill left by heaped trucks...from around grizzlies, conveyors, trestles. A clean plant area speeds mobile equipment operation, reduces dust.

5 Keep stockpile toes pushed in—weather and loading operations result in spread of toes around stockpile. This limits working space, wastes stored material. Also, working thinly-spread toes down-grades material, increases loading cost.

6 Keep dumps smoothly spread and level—regular grader service can spread dumped material clear over edge. Offset blade reaches far out beyond wheels. A smooth, level, dry, dump speeds both hauling and dumping, cuts equipment costs. Grader can easily smooth haul road as it travels to and from the dump.

7 Clean ore benches of washed-down dirt—every rain washes dirt into upper benches, lowers quality of mined material. Prompt grader service halts "wash", provides planned drainage, piles washed-in material for easy removal by scraper or truck.

8 Assist exploration teams—a modern grader can build a well-graded and drained roadway in a matter of hours...speeds exploration work by maintaining good roads for hauling men and equipment.

9 Keep drainage open—with just a few hours work per week, a modern grader will keep ditches clean ...provide fast run-off, preventing seepage of dirty water into pit bed. Planned maintenance eliminates erosion of haul roads, keeps trucks and shovels operating on dry footing.

Check capacity of your present graders

It will pay you to re-assess the role and capacity of your present graders. If your machines are more than a few years old, you will probably realize a substantial increase in grader productivity by replacement with modern, fast, powerful, big-capacity graders. Call or write for full information on Adams heavy-duty graders. Six models: 190, 150, 123, 104, 80, and 60 hp. Choice of GM or Cummins engines on 5 larger models.

This 150 hp Adams 660 grades haul roads, at speeds to 6.5 mph, in 4th gear. Unit smooths surface for high-speed movement of production haulers. Travel speeds to 26 mph.

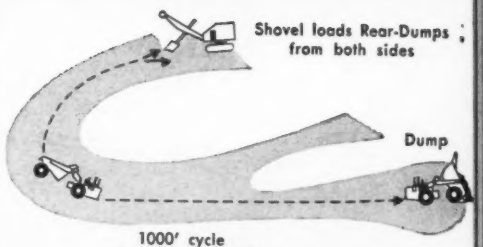
Adams — Trademark AG-1352-M-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

Haul heaped loads over slippery clay footing at Georgia Coating Clay Co. Pit



At a flip of a switch, operator activates electric switch to raise Rear-Dump body into dump position. Streamlined bowl sheds material fast. Note exposed kaolin in background.

Within the year, Georgia Coating Clay Co. will produce 90,000 tons of kaolin at Pit #5 — one of their 5 mines in the Macon, Ga., area.

At this pit, 11 miles east of Macon, a 1½-yd. Koehring shovel and two 11-ton D Tournapull Rear-Dumps are stripping a 25′ layer of sand and red clay to expose rich kaolin deposits.

Hauls 7 yds. per load

Shovel operator heaped 7 yds. of overburden into Rear-Dump's wide (5′ 10½″) bowl in 1 min., 7 sec. Although rains made clay haul roads wet and sticky, each Rear-Dump consistently hauled heavy loads 500′ to dump site in average of 1 min., 24 sec. Haul included 200′ of 6% uphill grade out of the pit. On the dump, "D" backed in, spotted and dumped in 8 sec. Then, it pulled away and returned over same, slippery haul road to complete 1000′ cycle in average of 3 min., 49 sec.

According to Mine Supt. Frank Fountain, when clay road was dry, Tournapull Rear-Dumps cut cycle time to 3 minutes . . . increased production at the pit by one-third.

"Outstanding in rock"

Tournapull Rear-Dumps were moved to this tough stripping assignment, at Pit #5, after they profitably stripped 90′ overburden at Georgia Coating's other pits. Fountain said, "We were in trouble at this pit until we got these Rear-Dumps, and they brought us out. They did outstanding work in both tough rock and 'water sand'. I like 'em 'cause they're easy to maneuver under a shovel. They can pull themselves out of the soft dumps easy, too."

"D" scraper . . . valuable pit tool

Georgia Coating also uses a D Tournapull scraper on exploratory stripping operations. Besides stripping, versatile "D" loads, hauls and spreads sandy topsoil over the slick clay haul roads to speed hauling operations.

3 sizes; interchangeable work units

Tournapull Rear-Dumps are available in 3 sizes: 11, 22, and 35 tons. All can be interchanged with other trail units for year-round specialized work. Call or write for full specifications.

Stripping 25′ overburden, shovel operator easily heaps good load into Tournapull Rear-Dump. Low rear-entry permits quick swing-out of empty dipper with door open.

D Tournapull scraper self-loads, hauls, and spreads topsoil over sticky roads to provide more traction for haulers . . . handles variety of pit jobs including exploratory mining.

Tournapull—Trademark Reg. U.S. Pat. Off. DRDP-1059-Q-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

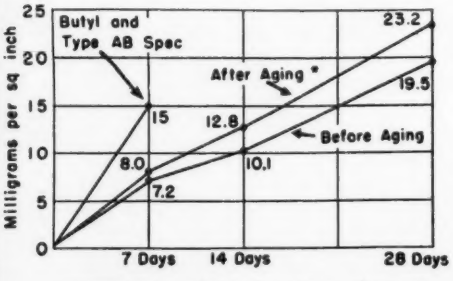
A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

ANACONDA TYPE SH-D Shovel Cable with neoprene jacket, Type AB butyl insulation—a good companion in wet locations.

New champ in the "old swimming hole"

—Anaconda Type AB butyl-insulated Shovel Cable



RESULTS OF mechanical moisture absorption test show Type AB absorbs less than *half* the moisture Industry Specifications allow.

Where shovel cable is exposed to rain, snow or wet spots — moisture-resistant properties of the jacket *and insulation* are vitally important.

Latest test results show Anaconda Type AB butyl insulation (used in Anaconda Shovel Cable) *absorbs far less moisture* than the criterion set up by Industry Standards.

Result: longer cable life . . . greater freedom from failure . . . less down time for users of Anaconda Type AB-insulated Shovel Cable.

NEW ENGINEERING BULLETIN EB-27 has full details on performance of Anaconda butyl insulation in 15 Industry Specification tests. Ask the Man from Anaconda for your copy. And see your Anaconda distributor for your Shovel Cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 57319

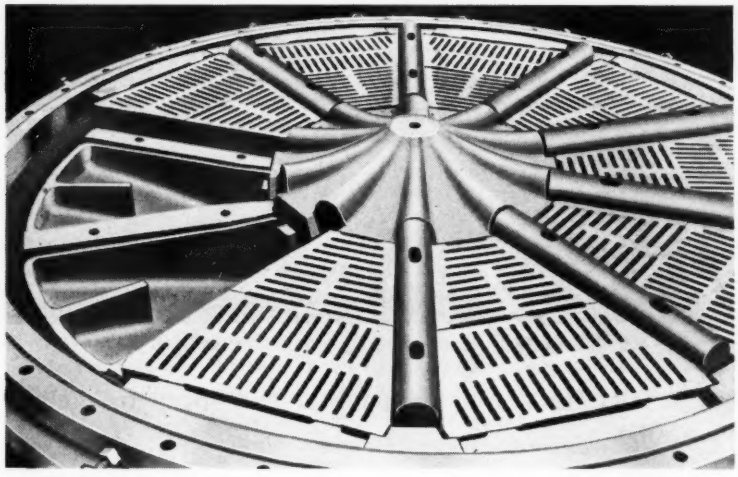
SEE YOUR ANACONDA® DISTRIBUTOR FOR SHOVEL CABLE

initial or operating cost?

see how Marcy can give YOU long-time economy

Low production costs are becoming more and more important for profitable operation. Continuous, dependable performance of milling equipment is essential for low costs...but, low initial equipment cost does not assure low-cost-per-ton production.

The predominance of Marcy Mills in large companies having big tonnage and continuous operation is evidence of Marcy's superior performance...repeat orders from these companies prove the preference for Marcy design and construction for low-cost-per-ton production.



"Rapid Change of mill content is necessary for high efficiency." That's the Marcy principle of grinding. It is accomplished by use of *full-grate* discharge on Marcy Ball Mills and the *open-end* feature on Marcy Rod Mills. It has proved to increase tonnage up to 33% and decrease KWH per ton, compared with overflow type mills... one reason why Marcy gives lower cost-per-ton and makes a better long-time investment.

NO EXTRA CHARGE FOR MARCY EXPERIENCE

THE MINE AND SMELTER SUPPLY CO.

DENVER NEW YORK SALT LAKE CITY EL PASO

KEEP COSTS DOWN *with help like this . . .*

- TORQUE CONVERTER DRIVE . . . matches power and speed to the job requirements automatically
- 1,000-HOUR LUBRICATION INTERVALS . . . for truck wheels . . . eliminates daily greasing
- ONE-PIECE STEERING CLUTCH AND FINAL DRIVE HOUSING . . . insure perfect alignment, long life
- UNIT CONSTRUCTION . . . makes major service simple, fast
- ALL-STEEL BOX-A MAIN FRAME . . . provides full-strength protection

All pioneered and proved by Allis-Chalmers . . . five of dozens of basic advantages that help hold costs down . . . handle more jobs . . . contribute to a profitable operation. Now is the time to have them working for you. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

Atlas Copco produce world's lightest motor drill

From Atlas Copco, the world's largest manufacturers of pneumatic rock-drilling equipment, comes an entirely new motor drill. It is the Atlas Copco *Cobra*, backed by 50 years' experience of rock-drilling equipment, and developed after extensive field tests.

Weighing a mere 53 pounds, the Atlas Copco *Cobra* is undoubtedly the lightest, handiest motor drill ever brought out. (The usual weight of a motor drill is around 80 pounds.) Yet despite its low weight the Cobra is able to put up a *higher footage* under actual working conditions than other, *heavier* motor drills. It is powerful, robustly constructed and, above all, *100 per cent self-contained!* One man can carry it and start it up *anywhere*.

New exclusive drill features

The Atlas Copco Cobra has 100 per cent air flushing from the built-in compressor. As no exhaust gases are used for flushing, troublesome decarbonizing is eliminated. Another *first-ever* feature is the free-wheeling mechanism for easier starting and more rapid steel changes. The Cobra also incorporates a unique new method of automatic rotation of the drill chuck, a floatless carburettor enabling drilling up to a 45 degree incline and a pull-type starter. The Cobra drills 100 feet to the gallon, has a drilling rate of 26 feet per hour, and can drill holes up to 13 feet in depth.

The right steels for the Cobra

The Cobra—like all Atlas Copco drills—has been developed for use with *Sandvik Coromant* steels, the world's most widely-used integral drill steels. This, of course, adds considerably to the performance of the Cobra. *No drill or steel developed separately could possibly give such equivalent high results.* Atlas Copco drills fitted with Sandvik Coromant steels have proved an unbeatable drilling unit, responsible for the drilling of no less than one billion feet each year.

World-wide sales and service

The Atlas Copco Group embraces Atlas Copco companies or agents manufacturing or selling and servicing Atlas Copco equipment in ninety countries throughout the world. For further details of the equipment featured here, contact any of the addresses shown below.

U.S. — Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA — Atlas Copco Canada Ltd., Montreal Airport, P.Q.

MEXICO — Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.

Motor Drill and Breaker in one!
The Cobra converts to breaker in minutes. Only three small parts to change. Reconversion just as quick.

Easily carried anywhere! *Perfectly-balanced carrying handle. Moulded back frame for transporting cross-country.*

Grinder driven from the Cobra! *A specially light drill steel grinder, powered through the crankshaft, can be supplied if required.*

DSS/61

Atlas Copco

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

Fast D Tournapull, owned by Texas Lightweight Aggregate Co., gathers speed leaving processing plant for 1-mi. trip to loading area. This one "D" — plus crawler-mounted front-end loader, and a tandem-disc plow — replaced a fleet of 4 tractors and 2 towed scrapers.

At Haydite plant, one "D" replaces hauling fleet

moves same quantity in 1/3 less time!

Haydite is the tradename for lightweight expanded clay and shale aggregate, manufactured by Texas Lightweight Aggregate Company at the Stafford, Texas plant a few miles southwest of Houston. Black clay is broken up into marble-sized chunks, heat-expanded in rotary kilns, then cooled. The rock-hard finished aggregate is sold to ready-mix plants and manufacturers of concrete products for lightweight concrete and masonry units.

To keep its Rotary Kiln Haydite aggregate plant in Stafford, Texas, supplied with black clay, Texas Lightweight Aggregate Company, a division of Texas Industries, Inc., relies on one D Tournapull and a crawler-mounted front-end loader with tandem-disc plow. The "D" — working 16 hrs. daily — replaces 4 slow-speed tractors and 2 towed scrapers that worked around the clock to supply plant at the same rate.

The clay used is plastic, and very dense . . . hard as a rock when dry . . . soft and slippery when wet. The trick is to excavate it with just the *right* moisture balance — then haul direct to kilns or stockpile it in a sheltered area for future use. Condition of clay deposits at any given time depends on the weather of many preceding days and must be disced properly to maintain proper moisture for special loading.

Hauls over 2 to 4-mi. cycles

Sometimes, when stockpiles run low, a large amount of clay must be moved in a few hours to supply the kilns. Strip-mine areas are about a mile from the processing plant. Because good-sized yardages have to be loaded and moved fast, Texas Lightweight Aggregate finds Tournapull just the right machine. Working alone, "D" handles a job that previously required many machines.

Single Tournapull supplies materials

Total excavation, loading, pit-to-stockpile hauling, and dumping on shed, is handled by this single Tournapull. Rig self-loads as much as 6½ loose yds. per trip . . . hauls up to 1 mi. to stockpile sheds at speeds to 29.5 mph.

Spreads in tight quarters

Dumping at the plant involves careful maneuvering. The stockpile is next to the kilns, under a large shed. Turning space is restricted. The "D" frequently has to climb up and dump over previous stockpiles, with limited overhead clearance. 90° turn, electric power-steer through geared king-pin lets this LeTourneau-Westinghouse earthmover maneuver easily into the shed . . . spread . . . and swing out for another load in seconds.

"They turn fast and they're maneuverable," commented Richard Messer, Stafford Plant Superintendent. "They get out quick and back quick — both on the pick-up and spread, that differential helps us work good in mud during wet weather."

Get facts for your type work

If your earthmoving operations require steady production, plus hauling over a considerable distance, it will pay you to investigate the advantages of the 9-yd. D Tournapull, or the larger 18-yd. "C" or 25-yd. "B" sizes. Let us show you owner-verified facts on Tournapull production for *your* type of work.

"D" turns as it dumps on clay stockpile. In another 10 seconds, rig will be returning at high speed to loading area.

Tournapull—Trademark Reg. U.S. Pat. Off. DP-1051-M-b

Editorials

ROBERT W. VAN EVERA, *Editor*

MARCH, 1957

Engineers Wanted

A newspaper editor recently testified before the House Education and Labor Committee that Soviet teachers load mathematics and science on their pupils, aged 7 to 17, six days a week, ten months a year, with exemption from military service offered to young students who make their grades.

He said that sixth graders bone up on elementary mechanics, heat and electricity, and that eighth graders are making sense out of mechanical and kinetic energy. By the time they are ninth graders, they're studying acoustics, aerodynamics, and heat. And some of the more advanced technical courses are mandatory in senior high schools.

By comparison, he told the congressmen, 24 percent of the high schools in the United States offer no geometry and 23 percent no physics or chemistry. He reported that only four percent of last year's high school students in this country studied physics.

Does all this mean that we have an inferior school system? Certainly not! But it does indicate a lack of interest in mathematics and science. This problem must be solved if America is to avoid a critical shortage of scientific personnel in the not too distant future.

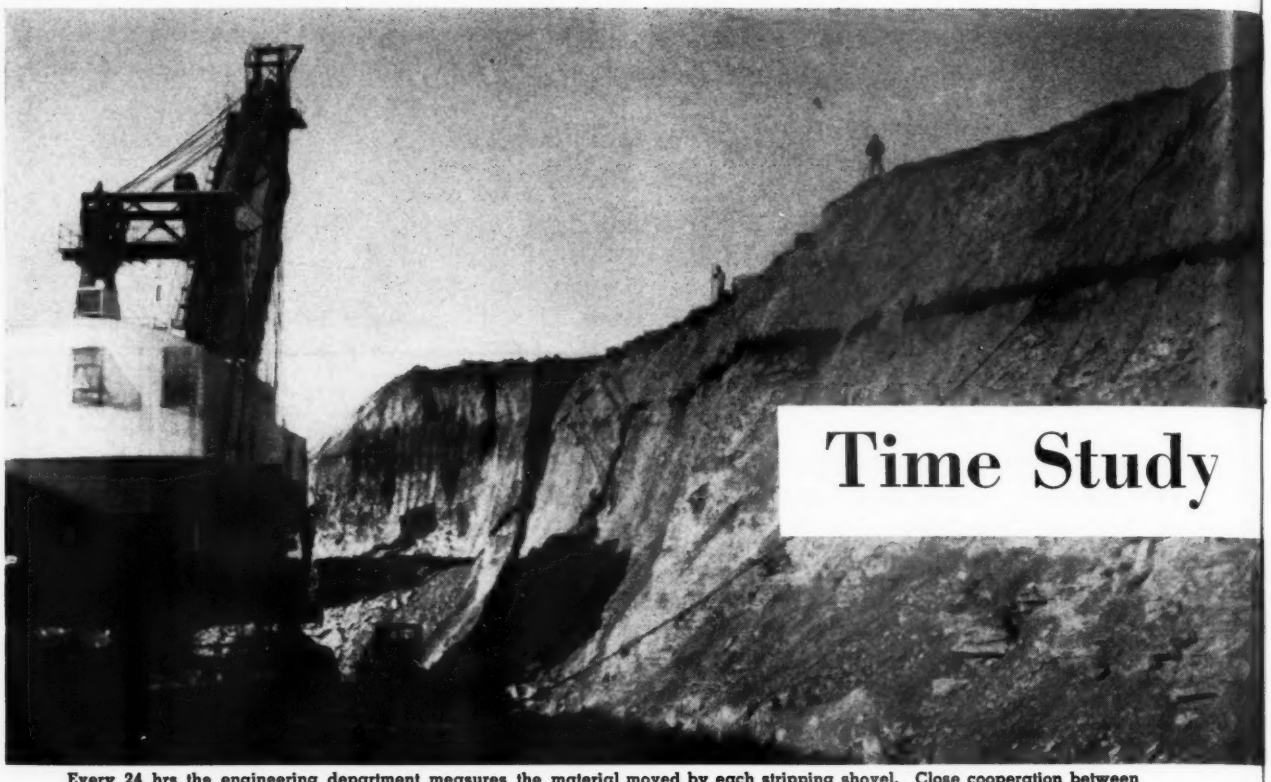
There is one group in this country that can probably do more than any other to stimulate student interest in scientific and engineering fields. We refer to American industries. Who else can better outline the opportunities for tomorrow's scientist than the industries providing tomorrow's jobs?

There are several ways by which industries can attract students into critical fields. Through the media of the press, radio, television, and film, a clear picture of vocations such as mining, metallurgical or fuels engineering can be presented, based on the experience of those already in the field. The need for trained men in certain lines can be stressed.

Scholarships and field trips put the student and a company on a more personal basis. Field trips give a young man trying to decide his future career first-hand information about a particular profession or industry. In addition, such visits give the company a chance to get acquainted with prospective employes. They create good will on both sides and give the student a better understanding of what he reads in his textbooks. Scholarships, of course, provide students with incentive and financial assistance.

An industry facing a shortage of scientists or engineers should also take stock of the attractions it has to offer students. Are salaries commensurate with job responsibilities? Are living conditions, security and fringe benefits on a par with other industries? Inferior conditions should be corrected and good points capitalized on.

The American youth has an insatiable thirst for knowledge; thus we need have no fears about this country's facing a shortage of scientific personnel—providing we do our part in furnishing necessary educational facilities, proper guidance, and good job opportunities.



Time Study

Every 24 hrs the engineering department measures the material moved by each stripping shovel. Close cooperation between management and the engineering department is necessary if maximum benefits are to be obtained from a time study

TIME study is an important tool of the industrial engineer for improving performance and efficiency to reduce costs. Of the various ways by which management might reduce costs, the most permanent and therefore the most important is by improving performance and efficiency of both the machine and the man.

As applied to stripping shovels, we have long ago reached the point where very little physical energy is required. We find that the human element in the machine and man equation is a factor depending primarily on mental ability, training and education and plays a very minor part, although an important one, as far as reducing costs are concerned. The machine element offers the widest latitude for reducing costs.

Costs can be reduced by getting more useful work done per unit of time and by increasing the percentage of actual working time. The best way to start is by making a time study.

Correct Operating Conditions Indicated by Studies

A time study applied to stripping shovels can be very simple and inexpensive, but the benefits will be most gratifying. In order to get the maximum benefits from such a study, there must be an understanding and knowledge of the conditions under which the stripping shovel must work, as well as the nature of the bank material to be dug. A time study will indicate when an improvement in shovel performance can be achieved by changing the conditions under which it operates. Conditions such as coal pit or spoil pit width, riding berm width, water in the pit, nature of coal seam, haulageway entrances to the pit, haulage equipment and methods of passing the shovel, and depth of overburden all directly affect shovel performance.

The nature of the highwall material is a very important factor. A time study will indicate whether or not bank preparation by blasting is required. It will also tell when the most economical point of bank preparation has been achieved.

Pit operating conditions and bank preparation that are the most economical for a 20 cu yd shovel should undoubtedly be changed somewhat for a 40 or 60-yd machine. A time study will show what changes should be made.

The successful evolution and growth from the 8 to the 60 cu yd machine of today was due to a great extent on time studies of these shovels. The time study is a yardstick for developing and designing bigger and better stripping shovels.

Time studies can be divided into two parts: A continuous time study record of general performance for effective control and over-all improvement and second, an intermittent detailed time study of each motion and element of shovel operation. The latter is to control and improve such elements as time of swing, time of crowd, time of hoist in filling the bucket, time of hoist in raising the bucket over the spoil area and to balance these time elements in a full cycle.

Shovel Performance Measured

By the use of continuous time study reports, management is not only able to bring the shovel efficiently up to its maximum but to keep it there. The minute the efficiency drops, management knows it and can do something about it. Indicated ways of improvement will be apparent from these time studies, such as changes in digging methods, mechanical changes in the various component parts of the machine, changes in the shape of the bucket and teeth, major changes in machine design and changes in electrical equipment.

The time study method used by Midland Electric Coal Corp. is very effective and simple and has been used continuously since 1929. The methods of gathering that statistical data and

An Illinois coal mine's experience with time studies illustrates the potential of this important tool of the industrial engineer for improving performance and efficiency and reducing cost

By WM. W. YOUNGBLOOD
Superintendent Mine No. 2
Midland Electric Coal Corp.

on Stripping Shovels

the general arrangement of the various report forms have changed somewhat over the years, but basically, the same system is used today that was used in 1929. Once a time study system is established, it should never be changed; this permits an accurate relative comparison of performance from day to day, month to month and year to year over a long period of time.

The volume of material dug by our shovels is a solid in-place cu yd calculated from accurate survey measurements of both area and depth. These measurements are taken at the end of each 24 hr day. A large scale con trol map of the working area is plotted daily and areas dug each day are measured by a planimeter. These control maps are also used for detailed planning of pit progress and direction. Control maps are layed out on rectangular coordinates and show property boundaries, prospect drill holes, depth and nature of overburden, location and direction of natural drainage, public roads, coal haulage roads, buildings, fences, wooded areas and all other features that might be needed to properly plan the mining operation.

Esterline Angus Recorder

An accurate time record and total angle of swing is obtained by use of an Esterline Angus Time Recorder that is mechanically connected to the swing gears. The method of adapting this recorder and the gear train and mountings were developed and designed by R. L. Leseney, master mechanic for the Truax-Traer Coal Co., Canton, Ill., who is one of the pioneers in the operation of stripping shovels. All of our stripping shovels are equipped with these recorders, purchased from Leseney; the cost is reasonable and maintenance over the years has been practically nothing. The accuracy of this device is unquestionable and has reduced our labor cost by replacing one man for each stripping shift.

The Esterline Angus Recorder has a spring operated clock which continues to run during all electrical power interruptions. The paper roll is graduated in its length in five minute intervals for a total time of seven days. It is graduated over its width in degrees of swing; the center of the roll being 0 and increasing on each side to 90°. The recording needle is actuated by a cam that is connected by a gear train to the main swing gears of the shovel in such a way that the cam makes one revolution when the upper deck of the shovel makes a full revolution.

In making a full shovel revolution of 360°, the recording needle moves from 0 to 90° on one side in the direction of the shovel swing, then returns, passing across the 0 center line and on to the 90° mark on the opposite side and finally back to the center 0 mark. Thus, by timing the gears so the needle reads 0 when the shovel boom is lined up parallel to the direction of shovel travel or pit direction, the recorder will show the exact degrees from center that each bucket of dirt is dug and the degrees from center where it is dumped on the spoil bank.

Valuable Data Furnished

A time study record of this kind is very important and cannot be accurately obtained without the use of some type of mechanical recorder. The most efficient digging and spoiling of each bucket of dirt can be determined and controlled.

When a shovel is not digging and swinging, no useful work is being done; this is shown on the recorder roll as a straight line of time lost. This lost or unproductive time is listed in our time study reports as "delays." In order to know what each delay time is for, we have a shovel operator's daily sheet in his control cab which is simplified to such an extent that all he is required to do is to put an X mark in line with the proper delay heading and in the time of day column when it occurs. These time columns are for intervals of 15 minutes. Any delay for which there is no special heading, is reported under "other delays" together with the nature of the delay.

From the recorder record and the operator's delay sheet, the engineering department makes a complete daily report of the time spent actually digging, time lost by each of the various delays and total swings. These daily reports are made for each of the three operating shifts. Information from these reports and yardage survey records is used to complete a monthly summary report for each shovel. This monthly summary shows the yardage and performance separately for each of the three operating shifts and shows cumulative yardage and performance from day to day for the full month.

At the close of each month and year, a final condensed report is made showing the total possible working hours and hours operated, percent of time actually digging, percent of unused potential digging time, cu yd dug, tons of coal uncovered and average depth of overburden. Also a monthly detailed delay sheet is made for each shift and each shovel.

Analyses of Time Delays

One way to get more productive work out of a shovel is to increase the actual digging time by decreasing the

delay time. The very nature of the delays is such that we have divided them into two general types, "Unused potential digging time" and "Time lost."

Unused potential digging time is lost time that is not due to the inability of the machine or operator to perform productive work. Delays such as no spoil room, pump water, move pumps, dig runways, pass shovels, etc., are unused potential digging time. Since these delays do not affect the shovels' ability to perform work, good management and planning will convert most of this lost time into productive work time.

The second type delay is time lost due to the inability of the machine and operator to perform productive work. Some of these causes are moving, oiling, leveling, wait on haulage truck, electrical, change electric cable, change hoist cable, mechanical delays, etc. Over the years, some of these delays have been eliminated or reduced to a very low point. Late model shovels have eliminated the lost time of leveling by using automatic leveling. Lost time of oiling has been eliminated or reduced to a negligible amount. Other delays such as moving, mechanical and electrical cannot be eliminated, but we should make every effort to reduce them. Of course, we know there is a point of diminishing return beyond which it would be unprofitable to go.

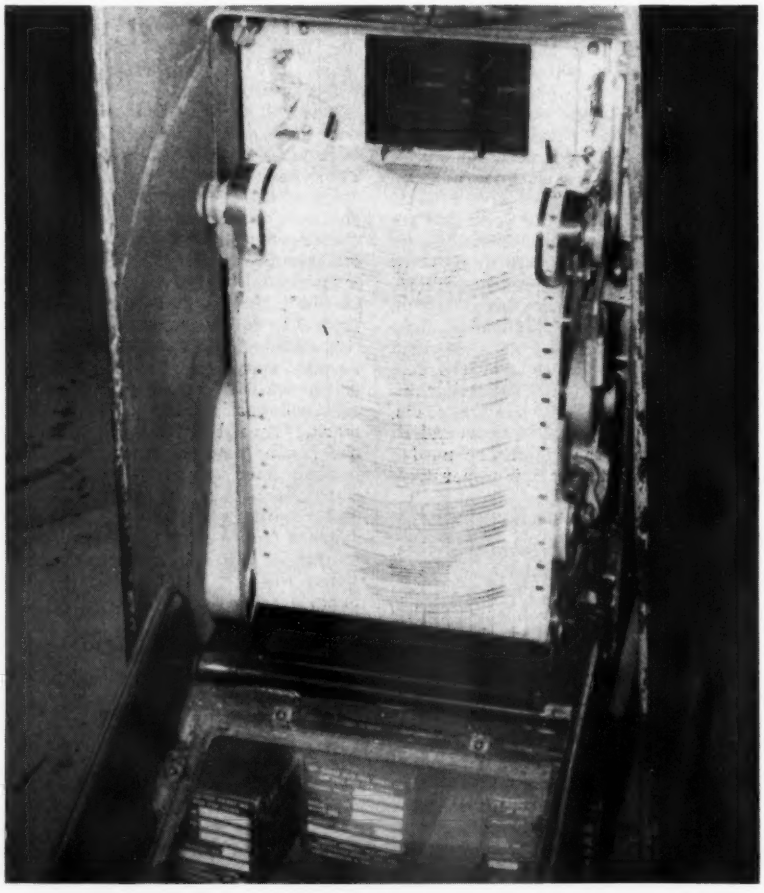
Methods to Increase Output

Another way to increase the productive work of the shovel is to decrease the digging cycle time and increase the bucket factor or yards per bucket. The time study will show when the most efficient pattern of digging is used. Once the dirt is dug from the solid bank, it has to be moved horizontally and vertically to the spoil bank. The greatest resistance to horizontal movement is the mass weight of the revolving deck, and a very large part of the resistance to vertical movement is the weight of the bucket and handle. From this we can see the importance of a full bucket, a short swing and a minimum hoist.

Whenever possible, and in most pits, it will result in more stable spoil banks if the lower part of the dirt in the solid bank or highwall is placed in the lower part of the spoil bank. This requires the shortest swing, and the short swing time takes advantage of the low time of the minimum hoist required. In the same way, the swing and hoist time can be kept in balance as the upper bank material is dumped at a higher point and around through a longer swing.

Maximum efficiency can be reached only when the time of swing and hoist of each cycle are in balance. The record of the time recorder will show in detail the digging pattern used and its

(Continued on page 48)



ABOVE: A large scale (100 ft to 1 in.) coal area map for advance planning and control; BELOW: The most efficient digging and spoiling of each bucket of dirt can be determined from time study records obtained with the Esterline-Angus Time Recorder

Trucks

For Open Pit Haulage

By C. V. ISBELL
President
Isbell Construction Co.

Well versed on contract haulage, C. V. ISBELL presents a keen analysis of the practical applications of the various types of trucks available for open pit haulage.

His experience dates back to 1906 when he worked for E. W. Scripps of Miramar, Calif., assisting in the design and construction of roads and dams. The Isbell Construction Co. was formed in 1913 and C. V. Isbell has been president since its incorporation in 1931. Under his many years of leadership, the company has engaged in building roads and airports as well as in many open pit mining operations.

* **Advantages and limitations of various models of trucks for open pit stripping and mining**

* **Benefits derived from using more than one type of truck in developing a pit**

* **Combinations of hauling systems**

IN presenting some ideas on the subject—the application of various types of trucks for open pit haulage—one point should be noted. In our experience we have never found two pits in which exactly the same factors could be applied.

As a general rule, highway type hauling equipment, that which is built primarily for use in cities and on paved roads, is not suitable for most pit operations. Even in jobs where tonnages are not demanding, we have found this type of truck is not capable of continuous uninterrupted operation. Frames give a lot of trouble or must be modified by "fish-plating," and tire and wheel sizes are normally too small. In short, the cost of maintenance for this kind of truck is such that they cannot be competitive for this type of work. As service units to the mining operations—yes, but as for production haulage there is better equipment available.

From here on the article will deal with those trucks which are designed and built purposely for open pit stripping and mining. There are a number of manufacturers of this type of equipment, and they all make many models suitable for most of the haulage problems.

First, let us consider the 10 to 15-yd two-axle rear dump truck. This truck is well suited to the smaller pits, and in the early development or pioneering stages of the larger operations. Where the working room is limited and the hauls are short, this truck is very good.

Going to the 20 to 25-yd three-axle rear dump truck, we like to use it where we have ample turning space, so as not to scuff the tires, and good haul roads. It can be overloaded where speed is not a prime factor, but only where heating is no problem. This truck lends itself to the longer hauls, and if dumping overboard is necessary, this unit is safer than the two-axle truck.

The 32-yd three-axle rear dump truck would be used very much under the same conditions as the 25-yd rig, but having more power, carrying a larger load faster, boils it down to a volume determination. It has large expensive tires and cannot operate at a reasonable cost on rough roads or short turns.

There is also a 40 to 50-ton two-axle truck using very large tires and a 400-hp motor which should be able to handle steeper grades faster than some of the other units. Again volume may be the prime consideration. We understand that Kaiser is using some of these units on a level or downhill haul but have not had the opportunity to go into the details of this truck.

Tractor-Trailer Units

We use the 15 to 25-yd tractor trailer bottom dump units where we can handle good material, dump on top of the fill and later bulldoze it over. One of the main points on the bottom dump is that they can unload on the fly, not losing time on the dump. We prefer, and we believe that costs justify, to use both large and small bottom dumps together with a few rear dump trucks in the same ring. The large units on the longer hauls, the smaller units on the shorter and tighter places, and the rear dumps for handling the rock and other material which might not pass through the bottom dump. The economics of this rig is helped considerably by the lack of hoist maintenance. We avoid the use of bottom dumps or tractor trailer and semi truck units where considerable mud or slipperyness is encountered or where steep grades are planned.

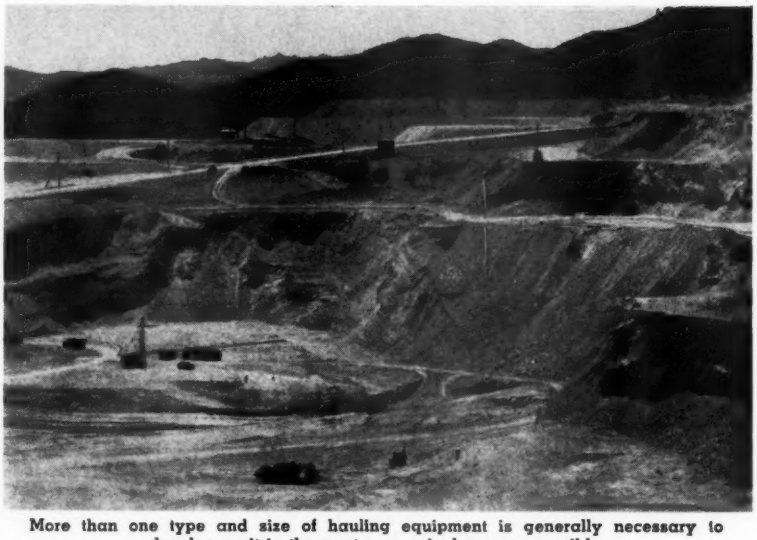
The 45 to 55-ton tractor trailer and semi truck rear dump again is a large volume consideration, and it is equally as good on a short haul as on a long

haul, provided you have easy grades, say up to four percent. The trailer type equipment reduces maintenance on the tractor or earthmover unit as there is not as much strain on the equipment or tires; however, this kind of equipment requires more working space than the short coupled rear dump trucks.

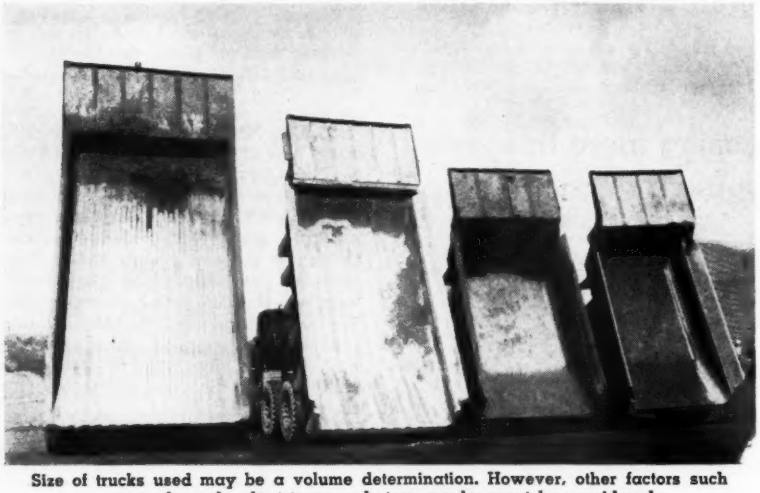
Several Types of Trucks Required

So far, over the years that we have been doing open pit stripping and mining, we have never found that "ideal" situation where the pit could be engineered and designed to competitively use just one type and size of hauling equipment. If that "ideal" cropped up very often, it might make it a little hard to sell our services of contract stripping and mining.

By far the most common situation is that the original pit plan will require one type of truck for pioneering and the early hauling, and perhaps several other types of trucks to complete the development of the pit in the most economical manner possible. Another thing which happens very often, as the work progresses it becomes necessary to revise the operational plan. In these cases it is sometimes possible to accommodate these revisions by using the same truck unit, but very often money can be saved by using a unit more suitable for the new conditions. It is situations such as these that provide much of the market for our services.



More than one type and size of hauling equipment is generally necessary to develop a pit in the most economical manner possible



Size of trucks used may be a volume determination. However, other factors such as rough roads, short turns and steep grades must be considered

Scraper Units Have Advantages

Although the subject referred to trucks, there are many places where other types of equipment might be more suited for the pit haulage. On a job we are now doing at Boron, Calif., scraper units are being used to very good advantage. This particular job is utilizing both the trailer type and the overhung type of scraper, and the choice of equipment here was determined by the kind of material to be handled and the size of the pit that was planned. The length of the hauls in this instance was not a determining factor. We find that the trailer type scraper handles better on the longer hauls, and instills more operator confidence; but on the other hand, the overhung type has better ability to get out into the sand and build road for the other units.

We also believe that certain pit conditions call for combinations of hauling systems—trucks to conveyors or railroads, and so forth. These combinations have a definite place in the engineering of a pit for the best possible economic end result.

Over 13,000,000 tons of waste were removed on a contract basis from this Arizona open pit copper mine before ore production started. It is often desirable for a mining company to let a skilled contractor with a wide range of equipment do the stripping and initial ore production

Continuous and Conventional Equipment in High Coal

This coking coal property, important to the steel industry in the West, is divided into three mines geared to produce 1,700,000 tons of coal per year. The room and pillar system of mining is used in conjunction with continuous and conventional equipment. Upper benching is employed when the coal height exceeds ten ft. All coal is washed at a centrally located preparation plant

By J. T. TAYLOR
Mine Engineer
Kaiser Steel Corp., Sunnyside Mines

THE Kaiser Steel Corp. purchased a 70,000,000-ton coking coal reserve from Utah Fuel Co. in April 1950. This property is located at Sunnyside, Utah, and, at present, is the main source of coking coal for the steel plant located at Fontana, Calif.

The Sunnyside property is divided into the No. 1, 2 and 3 Mines. These mines are geared to produce a total tonnage of around 1,700,000 tons per year based on a five-day workweek. This is the result of an expansion program which has been in progress at Sunnyside for the last five years. Included in this expansion program were the tasks of completely reworking the ventilation and haulage systems, the modernization of equipment and the construction of outside facilities to handle this increased tonnage.

As a non-selective method of mining is employed in each of the three mines, all coal must be washed at a centrally located preparation plant. The run-of-mine product has a reject of about 22 percent if the washed coal is cleaned to a 6.5 percent ash content before shipment to Fontana.

Geology as It Affects Mine Operation

To best understand the mining conditions at Sunnyside it is necessary to know a little of the geology of that area. There are two minable seams in the region; the Upper and Lower Sunnyside. These outcrop along the Bookcliff Range and pitch downward at an average of ten percent into the mountains. The Upper Sunnyside seam ranges from three to six ft in thickness, and the Lower Sunnyside from 5 to 14 ft. A rock separation lies between the two seams and varies in thickness from a few inches to about 50 ft. Where the separation is but a few inches thick the composition is almost all bone or weak shale. As the thickness of the rock separation increases, the composition changes to a laminated sandstone with shale streaks.

The variation in the size of this rock parting accounts for two different mining situations. The first of these is when the separation is from a fraction of an inch to about three ft in thickness. Under this condition both seams and the rock are mined by upper benching. The use of roof bolts is very effective in this case as the top above the Upper Sunnyside is composed of from one to six ft of shale and then normally a substantial thickness of relatively strong sandstone. The second of these conditions is where the thickness of the separation prohibits the mining of both seams. In this instance the lower seam only is taken. Although the rock separation can be held after it reaches about six ft in thickness, it makes very poor top.

A massive sandstone known as the Castle Gate sandstone, lies about 150-200 ft above the two seams. This, coupled with the fact that the cover ranges up to 2500 ft, is another factor which makes roof control difficult. It is suspected that some squeeze conditions are brought on by this massive sandstone failing to break and distributing the weight over a large area. Bounces or bumps are also prevalent at the Sunnyside operation, and as the region is pitching, there is lateral movement as well as the usual crushing effect. It should be pointed out, however, that while these conditions normally work against production there are cases where they are helpful. For instance, the majority of the bouncing is of the non-violent type, and as a continuous miner sumps into the face the coal bounces down and very little actual cutting is needed. The good features are few, however, and the upper benching method of mining high coal was employed to control the ill effects of the violent bouncing and the weight.

Mining Method and Equipment

The conventional room and pillar system of mining is used in all three mines with development entries being driven, on the strike, from the main slopes to the boundary and connected up with the left or right side returns, as the case may be. A barrier pillar of approximately 200 ft is left to protect the returns and then rooms are driven up the pitch and the pillars extracted. This procedure is continued until the developed block of coal is extracted to within 400 ft of the main slopes, the remaining block being left to protect the slopes.

This system of mining is carried on both with the conventional and continuous miner units. To clarify the difference in what is termed as a conventional unit and a continuous miner unit the following is offered:

Continuous Mining Unit

Men	*Equipment*
1 Motorman	15-Ton Trolley Locomotive and 12 Five-Ton Mine Cars
1 Operator	10-SC Shuttle Car
1 Operator	11-BU Pick-up Loader
1 Operator	1-CM2 Continuous Miner
2 Roof Support	R-48 Stoper and Bolting Equipment
1 Section Foreman	

The equipment in the conventional sections is the same as the continuous

A newer trend in bolting at the Sunnyside mines is the heavy usage of the pierced plank type of war surplus airfield landing mats. These are bolted against the roof and offer protection against the rock falling out around the bolts

miner unit except a combination mobile cutting and drilling machine replaces the continuous miner, and the stoper is normally replaced by a dual boom roof bolting machine.

Conventional Unit

Men	*Equipment*
1 Motorman	15-Ton Trolley Locomotive and 12 Five-Ton Mine Cars
1 Operator	10-SC Shuttle Car
2 Operator & Helper	11-BU Loader
2 Operator & Helper	10-RU Cutting Machine with CD-40 Drill
2 Operator & Helper	DM-8 Dual Boom Bolting Machine
1 Shotfirer	
1 Section Foreman	

Extracting Full Seam

If the thickness of the seam is ten ft or less, the full height of the seam is taken on the advance of the entries or rooms. The break at ten ft was chosen as this is the maximum height the continuous miners, which are now in use, will take in one lift. Also heights greater than this usually offer many problems in clean-up and roof control due to the high ribs sloughing and the height of the roof making bolting difficult due to the staging involved.

When development entries are driven with a continuous miner, the practice is to drive only two headings. The cycle of operation starts with the continuous miner moving into whichever of the entries has the roof bolting complete to the face and starting to cut. The maximum advance of the entry, which can be made at one cutting and have the operator remain under the bolts, is about 18 ft; however, the more common advance is held to around 12 ft. This shorter cut is necessary to maintain control of the roof. After the cut is complete, the miner is moved to the other face, and the roof bolting crew moves into the freshly cut place and immediately bolts the exposed top. This procedure is continued until the entries reach their boundary and are connected to the bleeder returns.

After leaving the required barrier pillar, the first two rooms are advanced up the pitch with exactly the same procedure as the entries were driven. The centers for the rooms vary throughout the property depending on the natural conditions. Forty-ft centers, however, are about the average. When driving the room, a width of about 22 ft is maintained, leaving a pillar of approximately 18 ft.

Entries and rooms, when driven with conventional units, follow the same system except three or more headings must be driven to accommodate the additional equipment.

Upper Benching

When the coal heights exceed about ten ft, the seam is normally removed in two lifts. This is accomplished by upper benching. The upper bench system, as is used at Sunnyside, differs from full seam mining only in the respect that the entry or room is driven holding a height of eight or nine ft and the remaining coal left as bottom coal. This bottom coal is then recovered on the retreat with the extraction of pillars. Although the majority of the upper-bench mining takes place in coal heights of 13 ft, this method is being used successfully in two areas where the total height of the two seams and the split runs between 19 and 20 ft.

The continuous miner is very successful in this work as long as there is little or no rock split. If the rock split is much over one ft in thickness, the use of the miner is limited, and the equipment used is more likely to be the conventional unit.

Better roof and rib control is probably the most important advantage offered by upper benching. As both entries and rooms are driven next to the top rock and the height of the place held to eight or nine ft, by the leaving of bottom coal, the roof is within easy reach of a stoper or touch-up crew if extra bolting or support is needed. Rib sloughage is also greatly reduced thereby holding the heading to a more suitable width and eliminating much of the maintenance work which would otherwise be necessary as the coal sloughed away and left the unsupported roof. Another distinct advantage along this line is the fact that the rock is securely bolted as the development entries advance. The old method of driving entries under top coal worked very well on the advance but proved to be very poor practice on the retreat. The weight would come on the places as the pillars were extracted, and holding of the top coal proved very difficult as well as perilous. Under this new set-up there is no top coal to crush out, and the

rock is bolted. Also advantageous is the fact that the roof is secured before the bottom coal is removed, eliminating having to bolt or timber in places of extreme height.

The adoption of upper benching resulted from the experience gained in the rehabilitation of over 15 miles of old aircourses most of which were driven under top coal. The top coal had squeezed and broken and as a result many miles of aircourses were choked off with caves. Due to the height of 13 to 20 ft, it was practically impossible to adequately roof bolt and properly secure these aircourses in a manner which would provide permanency. It was then decided to drop the top coal where it was still in place and level off the caves leaving a fill ranging from four to ten ft depending on the thickness of the seam. This leaves an aircourse nine to ten ft high.

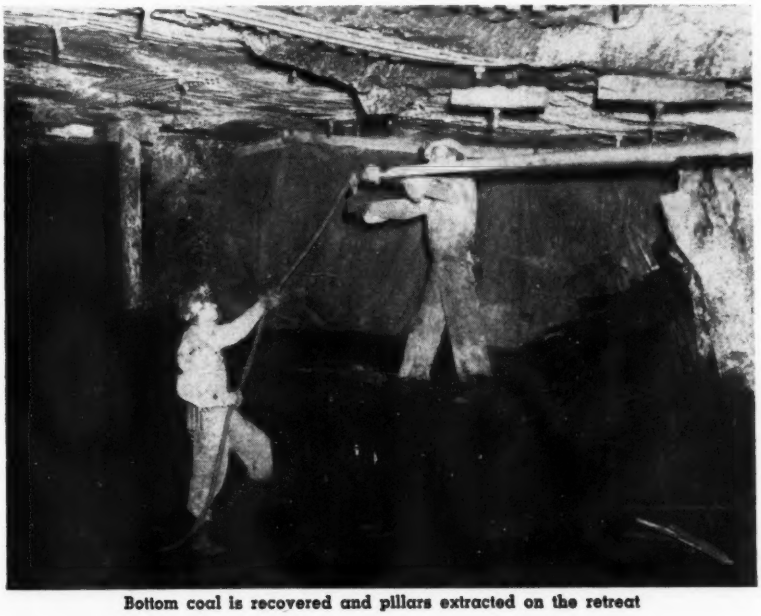
The advance of an entry (per cut) with the continuous miner is generally held to around 12 ft in order to maintain control of the roof

Pillar Extraction

After completion of the development entries, the extraction of the blocked out coal is next in order. The first step in this extraction is for two rooms to be advanced up the pitch, in the upper bench, until reaching the lower entry of the worked out section immediately above. The crew then moves down the room about 25 ft and splits the pillar, still in the upper bench, leaving a stump of about 12 to 15 ft on the upper side of the split. After splitting the pillar, the continuous miner drops back below split in the room and ramps downward taking the bottom coal in the room and the split. The continuous miner then cuts as much of the stump away as is considered practical. Drilling of the remainder of the stump by hand-held air drills is the next step. Then, if the roof condition permits, the shot coal is recovered by the pick-up loader, and the crew drops back, sets a breaker line of props and starts the next split. Shooting of the stumps is dual purpose: (1) To obtain the coal if the conditions permit, and (2) to effect a good cave regardless of the gain or loss of the stump coal.

As the pillar is extracted, the next room is started up the pitch, and the crew alternates working between the new room and the pillar extraction. This gives the roof support men a chance to bolt the advance of the room while the continuous miner is operating in the extraction of the pillar. The tendency is for the pillar work to move faster than the room advance. If such is the case, extraction of the chain pillars is used as the second place to work.

It was mentioned in a previous section that the rooms were normally driven on 40-ft centers and approximately 22 ft wide. This allows the continuous miner operator to make the split through the pillar and remain under the original support of the room, eliminating the need of completely bolting the split. If the rooms are driven on greater than 40-ft centers and the split cannot be made without the continuous miner operator leaving the protection of the room support, then the roof of the split is normally supported by the same means as was the room.



Bottom coal is recovered and pillars extracted on the retreat

The conventional unit follows a slightly different procedure. First, about three rooms are advanced up the pitch, in the upper bench, and then the bottom coal and pillars are removed in the same manner as described for the continuous miner section. The extra rooms are driven to provide working places for the shooting and undercutting portion of the crew. As encountered at Sunnyside, the continuous miner operation is much better because it allows less country to be opened up and that which is opened is mined faster and the chances of good recovery increased.

The big advantage of the conventional unit, at the Sunnyside operation, lies in the fact that both seams and the rock separation have been mined successfully even though the rock has reached a thickness of 72 in. In mining a section where there is a nominal amount of rock, the practice is to include the upper seam and the rock separation when taking the upper bench and mining all of the lower seam as bottom coal in conjunction with the pillar extraction.

Roof Support

Roof bolts are used extensively at the Sunnyside mines. These bolts are of the split rod and wedge type with a one-in. diam rod and range in length

(Continued on page 48)

Shaft Sinking with the Cryderman Machine

By J. C. O'DONNELL
Development Engineer
Shaft & Development Machines Co.

The machine's construction, its merits, and its successful application are described. With its positive power in loading the clam bucket and its versatility in operating in vertical or incline shafts, this mucker will no doubt see increasing use in the mining industry

At the lead end of the boom, two air cylinders actuate the clamshell jaws, providing positive operation of the mucker

THE Cryderman shaft mucker, a recent Canadian development, has introduced a novel idea into the practice of shaft mucking. With 38 of these machines now in operation throughout the provinces of Canada in addition to three now in use in the States, it is interesting to note the merits of this machine.

The designer has incorporated a new mechanical "human arm" action that makes loading rock in shafts a positive one-man operation. Because of its simple construction, this machine is readily adapted to round, square or rectangular shafts. Retaining the same simple principle of gimbal bracket and telescopic boom, it is now being used successfully in incline shafts which greatly adds to the machine's versatility.

The mucker has a 20-ft cage that, for ease of installation, is built in two 10-ft sections. Guide shoes on the top cage section permit ease of movement in the shaft. Under normal ground conditions the cage unit can be lowered below the supports or timber for mucking, but in shafts where heavy ground requires that timber be carried close to the shaft bottom, the machine will operate inside timber by the removal of the two lowest dividers.

Positive One-Man Operation

For handling the mucker in the shaft, two methods are employed: (1) Direct connection to the hoisting cable whereby the machine is hoisted or lowered as easily as a shaft bucket; and (2) mounting of a tugger hoist in the cage on a platform above the operator where, by double blocking, with a four-part line, the operator can raise or lower the unit as he so desires. Safety chains are attached to the shaft wall or timber for securing the machine when it is not being hoisted or lowered.

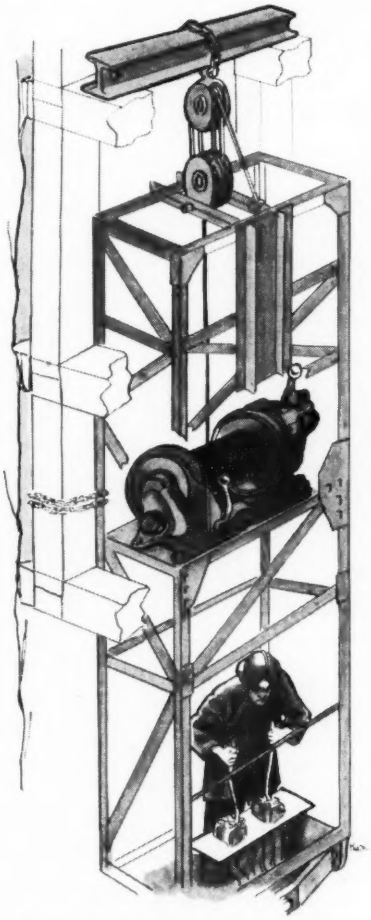
Located in the cage bottom, the operator manipulates two joystick levers that control the positive action of the seven air cylinders.

With this positive control of the multiple directional valves, he is able to extend or retract the telescopic boom, open or close the clam bucket jaws, and move the clam bucket to any place in the shaft bottom. From the safety of his cage position, the operator never enters the hoisting area, yet he has a full view of the mucking operation.

A gimbal bracket is built into the bottom of the cage and from it is mounted the telescopic boom. The two swing cylinders attached to the boom are hung from either side of the gimbal; these cylinders permit a boom swinging distance of 14 ft to each side which is helpful in mucking station cut-outs. The raising and lowering action of the boom is accomplished by two cylinders which are attached from the back of the cage to the boom. On the clam shell end or front end of the boom the opening and closing of the clam shell is actuated by two air cylinders.

The main cylinder within the telescopic boom permits a 15-ft extension, giving the boom an over-all length of 32 ft from the gimbal bracket. Unlike a gravity action, the operator's control of the main boom cylinder gives a positive downward pressure at the point of digging which means a positive positioning and loading of the clam bucket. Being able to crowd the clam bucket into the muck pile for a full load or to pull large boulders from the muck pile is a feature of the machine.

After the clam bucket is filled, the telescopic boom is retracted into position to discharge into the sinking bucket or skip. Efficiency in loading is accomplished by setting the machine for a minimum of boom retraction and by mucking close to the sinking bucket to eliminate unnecessary boom movements. When these conditions exist, it then becomes a problem of hoisting muck as fast as it is loaded.



The operator is located at the bottom of the cage where he works two operating levers while in full view of the shaft bottom. The Cryderman shaft mucker requires no support other than the regular guides in the shaft

137 Ft in 15 Days

Eight of these machines are being used in the Quirke Lake uranium field at Blind River, Ontario. In this area an outstanding sinking job is being carried on at Consolidated-Denison's No. 2 shaft. Here the contractor is using two of these muckers in sinking the 30 by 17-ft vertical shaft.

One machine is mounted in each end compartment, and with two double-drum hoists and four sinking buckets, the operation moves along without delay until the 140-bucket round is cleaned out in three hours' time. The ground is hard, abrasive quartzite that breaks well with some medium size boulders.

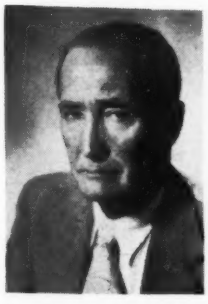
Success of the mucking operation is the result of good cooperation between the operators and the bucket men. The two machines keep working continuously until the round of muck is cleaned out, and, when waiting for the hoists, the operators are digging a hole for the buckets or leveling the muck to make easy walking for the bucket men. The only hand shovel work is scraping off the bench as the machines handle all the broken muck.

Being able to clean out the round in a minimum of time was a big factor in advancing the shaft 137 ft in a 15-day work period. During one day's observation 593 tons of rock were hoisted.

Large Boulders No Problem

At Basin, Mont., the first experimental model of this mucker was brought into the States for a shaft sinking job. The machine was confronted with a severe mucking problem as talcy seams in the blocky granite resulted in poor fragmentation. To overcome this condition, increased number of holes, different type rounds, and milli-second blasting were all attempted, yet the ground broke so big it was impossible to handle the large boulders by hand. Under these conditions the machine performed very well, being able to lift boulders and place them in the sinking bucket or pull larger rocks from the pile and set them aside for secondary blasting. The machine proved a big advantage over the former method used.

J. C. O'DONNELL grew up with The Anaconda Company, starting as a mucker and holding various jobs underground. He also worked in the company's Engineering Research Department for several years. At Idaho Maryland Mining Co., he started



as safety engineer and for five years was mine superintendent. Leaving Grass Valley in 1950, he spent 4½ years with Tungsten Mining Corp., Henderson, N. C., as mine superintendent. In October 1955, O'Donnell joined Roger Pierce in Salt Lake City in the promotion and sale of the Cryderman shaft mucker.

Incline Shaft Use

The first use of this mucker for incline work was made by East Malartic Mines, Malartic, Quebec. In deepening their 61° incline shaft through hard porphyry, one machine was placed on the footwall of each end of the five-compartment shaft. Muck from the 35 by 10-ft rock section was loaded into a 65 cu ft skip. Considerable slabbing of the walls produced large boulders, yet the two machines were able to average a skip load every 1¼ minutes for the 50-skip round.

Tugger hoists for raising and lowering the machines were used the same as in the vertical setup with the cage being built on skids for easy movement in the shaft. Larger lift cylinders were used, as the bulk of the muck lay against the footwall. Other than these changes, the machines were the same as used in the vertical shafts.

On all standard machines the clam bucket revolves. This permits the operator to muck either lengthwise or crosswise of the shaft. At the American Smelting and Refining Company's Page Mine, Wallace, Idaho, limited head room in the 55° incline shaft presented a problem in loading the

60 cu ft skip. To overcome this restriction a non-rotating boom was built into the machine. This kept the clam in a horizontal position at all times and required a minimum of head room for discharging muck into the skip. As the boom is stationary, telescopic air tubing placed along the bottom side of the boom replaced the two 25-ft hoses normally used on the standard machines.

Both in Canada and the United States, this machine has proven its application to work successfully under normal or severe mucking conditions in shafts of various sizes.

With positive power to load the clam bucket and its versatility to operate in vertical or incline shafts, this mucker will see a much greater use throughout the mining fields.

Time Study

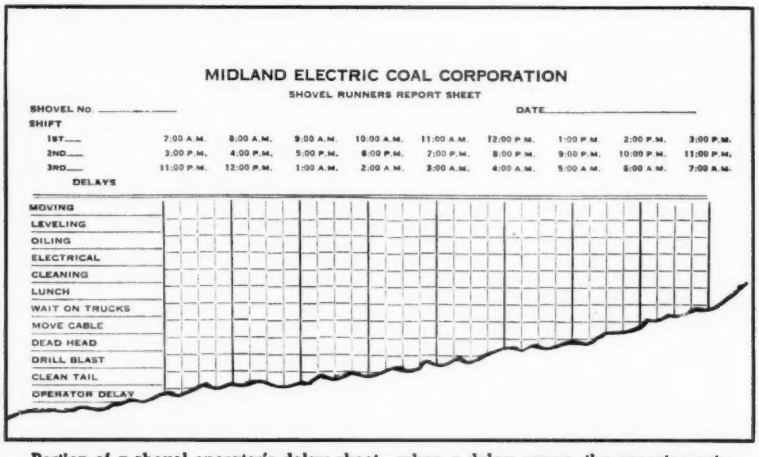
(Continued from page 40)

results. To get the highest efficient bucket factor, we need not only hoist power and speed, but also good bank preparation and a bucket design which will offer the least resistance to digging and filling. There are many different shapes and types of buckets. The best for your shovel and pit conditions can be determined by the reports of a time study.

Production Forecasts

Another very advantageous use of a time study is in future planning and estimating of coal production; in most strip mines this is limited to the capacity of their stripping shovels. By accurately knowing this capacity, the engineering department can make reliable estimates of coal tonnage for the months and years ahead. Planning can be made for pit progress and area development that will balance out to the best advantage for coal sales demand. This permits working high ratio cover during low sales periods and low ratio cover during high sales periods and keeps the sales department informed of the tonnage available in the future.

There must always be close cooperation between management and the engineering department in order that maximum benefits can come from the time study. A time study that is not accurate and complete is misleading. The engineering department at Midland Electric Coal Corp. like their slogan, "Do Not Guess."


MIDLAND ELECTRIC COAL CORPORATION

SHOVEL RUNNERS REPORT SHEET

SHOVEL NO. _____ DATE _____

SHIFT

1ST___ 7:00 A.M. 8:00 A.M. 9:00 A.M. 10:00 A.M. 11:00 A.M. 12:00 P.M. 1:00 P.M. 2:00 P.M. 3:00 P.M.

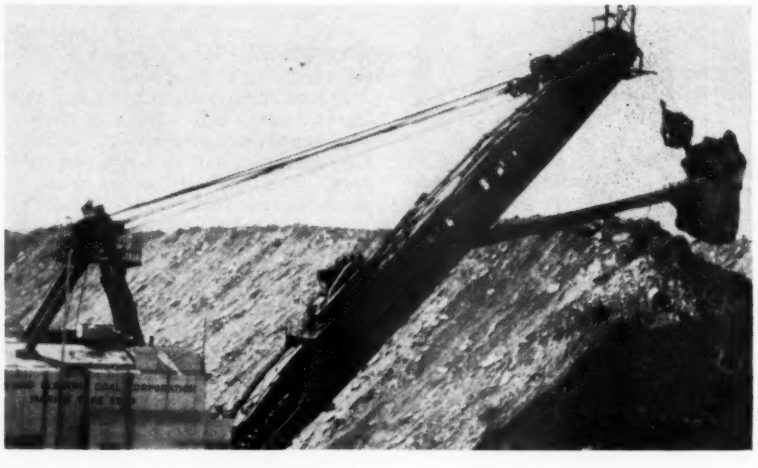
2ND___ 3:00 P.M. 4:00 P.M. 5:00 P.M. 6:00 P.M. 7:00 P.M. 8:00 P.M. 9:00 P.M. 10:00 P.M. 11:00 P.M.

3RD___ 11:00 P.M. 12:00 P.M. 1:00 A.M. 2:00 A.M. 3:00 A.M. 4:00 A.M. 5:00 A.M. 6:00 A.M. 7:00 A.M.

DELAYS

MOVING
LEVELING
OILING
ELECTRICAL
CLEANING
LUNCH
WAIT ON TRUCKS
MOVE CABLE
DEAD HEAD
DRILL BLAST
CLEAN TAIL
OPERATOR DELAY

Portion of a shovel operator's delay sheet—when a delay occurs, the operator puts an X mark in line with the proper delay heading and in the time of day column



RIGHT: When a shovel is not digging and swinging, no useful work is being done

High Coal Equipment

(Continued from page 45)

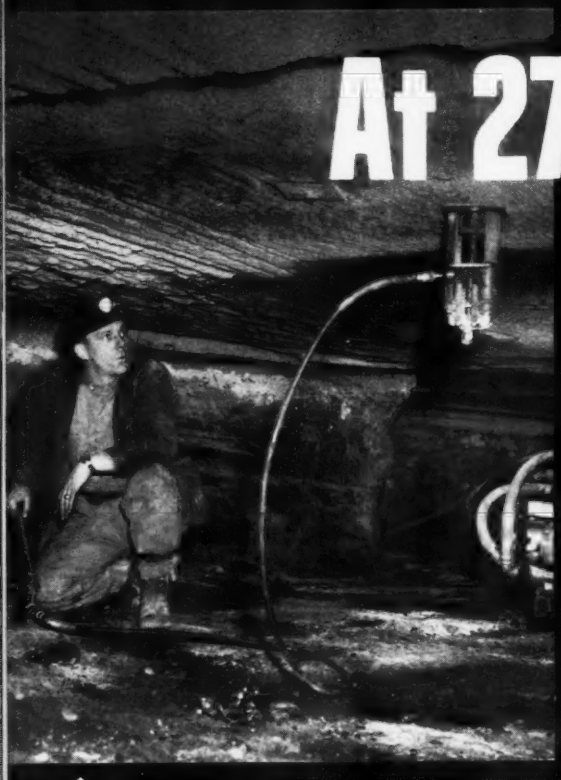
from four to ten ft. Standard spacing for the bolts is four- to five-ft centers; however, these centers are reduced if the top is poor. A newer trend in the bolting is the heavy usage of the pierced plank type of war surplus airfield landing mats. These are bolted against the roof, the same as channels or wooden planks were previously used, and offer protection against the rock falling out around the bolts. Other standard bearing surfaces used with the bolts are 8 by 8 by $\frac{3}{8}$-in. steel plates and 4 by 10 by 18-in. treated wooden blocks.

When working with the continuous miners, the bolting is done by a two-man stoper crew which works independent of the continuous miner; that is, the stopers are not attached to the miner, and the crew works in the alternate face from where the miner is cutting coal. The bolting of the roof with a conventional unit is different only in the respect that a dual boom bolting machine is used in place of a stoper crew, and at least nine ft of height is needed for this piece of machinery to operate.

All entry and aircourse work, plus most of the room work, is bolted as driven. There are exceptional cases, however, where good top prevails in a room section, and only straight props are needed for support. With such the case, the operator of the miner advances the face until the face is cleared for the next prop. Then work is stopped and the prop set. In some instances where the top is extremely poor, roof bolts and cross-bars are used in conjunction with one another. This is generally found where only the lower seam is being mined and the roof consists of the rock separation between the seams.

At 27,000 pounds . . .

At 27,000 pounds tension, a ¾-inch high strength roof bolt snaps like an overstretched rubber band. Because O-B shells and plugs consistently support extreme test loads like this, they contribute an extra margin of safety to any bolting program.



▲ O-B "pull test" is a practical demonstration of the holding power of O-B shells and plugs at any given location. Here, twin rams are fastened to head of an installed ¾-inch high-strength bolt in order to load the bolt far above normal tension of 9,000 to 10,000 pounds.

Pressure gage attached to pump allows bolt tension to be read accurately throughout test. In this picture, taken seconds before the bolt broke, gage shows tension of almost 27,000 pounds. ▶

Ohio Brass

....KAPOW!

O-B

shells and plugs

Bolt breaks at ultimate load of approximately 27,000 pounds. Photograph shows test equipment which fell to bottom as the bolt snapped.

Close-up shows how bolt stretched and "necked-down" before breaking. O-B expansion unit stayed put throughout the test, proving that in this particular roof its holding power exceeds the strength of the bolt. Pull tests like this one have proved time and again that O-B shells and plugs "go up easy and stay put" almost anywhere!

Keeps Mine Machines Moving!

O-B Magna-Trip Circuit Interrupters perform two vital functions to keep cutters, loaders, shuttle cars and other mine machinery moving.

(1) Magna-Trip protects trailing cables from the extensive damages, fires, and losses that frequently result from a short circuit in the machine or in the cable.

(2) Magna-Trip eliminates false tripping on heavy machine overloads.

Operators who have discovered this *entirely new* kind of protection from equipment and production losses are now using as many as 12 and 15 Magna-Trip units on the trailing cables of their face machinery!

Write today for more information about the job Magna-Trip is doing for them – the job it can do for you!

4804-M

Ohio Brass

MANSFIELD **OHIO, U.S.A.**

Trends In Underground Power

Coal production is now, more than ever, dependent upon a continuous flow of electrical energy delivered at adequate voltage levels to the working areas. An engineer outlines the trend in mine distribution systems and notes the growing interest in a-c power

By F. R. SELL
Senior Industrial Engineer
West Penn Power Co.

THE Btu (British thermal unit) is a very significant quantity. On its availability and on its cost, industries are located and centers of population established. This fact is more than evident today as the aluminum industry moves from the south and northwest into the Ohio Valley in search of low cost energy. This move is of importance because it indicates that the aluminum industry has confidence that the coal industry can produce the required tonnage at a cost that will remain competitive with other fuels. This confidence was earned by the coal industry's ability to meet increased labor costs with improved equipment and mining methods. This search for improved equipment and methods can never cease if the industry is to forge ahead in the future as it has in the past few years.

Estimated Future Coal Needs

Most economists now agree that the coal industry will be called upon to produce at least 100,000,000 additional tons of coal per year by 1965. This increased tonnage will be needed by the growing utility, steel, aluminum, and chemical industries as well as for other uses. The electric utility industry, for instance, is expected to double its load during the next ten years. To provide the increased tonnages required by 1965, it has been estimated that 50 new large modern coal mines will need to be established. It also has been estimated that 50 additional mines of the same capacity will be needed to replace depleted mines during the same period. These new mines, which will cost as much as $10 per ton of annual output will receive considerable attention from mining company executives. The best techniques and mining equipment will be used. Automation will be employed to an increasing degree in order to continue the trend toward increased production per man day.

Closely associated with improved equipment, better methods, and automation is the mine distribution system. Every year, the importance of the power supply to the modern coal mine increases. The reason for this, of course, is due to the fact that coal production is dependent upon a continuous flow of electrical energy delivered at adequate voltage levels to the working areas.

Requirements of Good System

Before entering into a discussion of trends in underground power systems, it would be interesting to look at the fundamental requirements of a good underground distribution system.

(1) **Provisions for Load Growth**—The distribution system should have sufficient transformer, conversion, and feeder capacity available to meet present needs and growing load requirements.

(2) **Flexibility**—The mine distribution system must be flexible enough to meet rapidly changing power requirements in the mine. Flexibility is more important today than it ever has been because the continuous miner and associated equipment moves fast, and if production is to be maintained, it is necessary to follow closely with a good power supply.

(3) **Voltage Regulation**—The performance of a mining machine is dependent upon the voltage delivered to the motor terminals. Poor regulation results in decreased production and increased maintenance costs.

(4) **Continuity**—The continuity of the power supply to a coal mine is important. An uninterrupted supply of power to fans and pumps has always been an absolute necessity for reasons of safety to personnel and protection of mine property. Continuity of service to coal producing machines has become more important because larger and larger tonnages have been assigned to each unit. Loss of production from one machine can greatly affect daily costs.

(5) **Operation**—A mine distribution system must be easy to maintain and operate. Provisions should be made to permit maintenance work to be performed whenever possible without shutting down essential equipment.

(6) **Investment** — Sufficient investment should be made to insure long term benefits.

(7) **Safety** — Finally, the underground power system must be safe.

Trends in Underground Power

With the above fundamentals in mind, let us investigate the trend in mine distribution systems. Starting with the power supply to mining customers, we find the power companies, in general, recognize the importance of mining loads and supply reliable single or two-way feeds. In some instances, mining companies purchase power at more than one location; generally, at major shaft and borehole connections. A diagram of the transmission system which feeds one of the largest mining customers served by the West Penn Power Co. is shown on the following page. The transmission voltage is 25,000 v. The system, you will note, provides two-way feeds to vital connections. Breaker stations and automatic air switches make it possible to provide a high degree of continuity of service to this customer.

Mine overhead distribution systems, for the most part, are 2300 v or 4160 v with 13.2 kv systems receiving some attention. Metal-clad switch gear equipped with induction relays has received good acceptance by most large coal companies. The mercury arc rectifier, because of its high efficiency and low maintenance cost, is receiving almost universal acceptance. The trend in this equipment is toward 500-kw units with some companies purchasing 750-kw units. True, there are a large number of MG sets and

rotary converters still in operation, but relatively few new units of this type are being purchased. Present rotating equipment is being equipped with modern overload protection and voltage regulators in order to improve the operation of this equipment. Portable rectifiers are being purchased for use on the surface as well as underground by many companies because they find it is easy to move them from one borehole location to another.

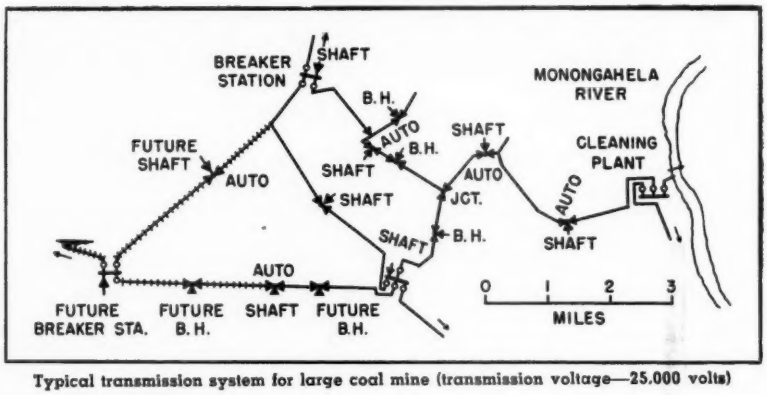
Some companies are presently using supervisory control to operate d-c breakers from remote locations. This carrier current equipment operates over trolley and power circuits at radio frequencies. By means of monitoring systems, it is possible to determine whether breakers are closed or open.

Before examining the underground power supply, let us take a look at the changes that are taking place in mining equipment and mining methods because these changes greatly influence the design of the underground power system. Locomotives, conventional mining units, fans, and pumps have changed little during the last few years. However, considerable emphasis has been placed on the development of the continuous mining machine. Much work has been done on "ripper" and "borer" type machines. One thing that is evident is that the power requirements of continuous mining equipment have constantly increased since the first experimental unit appeared in a coal mine. There are some people who feel that the maximum horsepower ratings have not been reached and is only limited by the quality of the mining bits now available. There is considerable attention being paid to secondary conveyor systems such as the extensible belt. With improvement in these conveyor systems, the continuous miner will operate at a higher load factor and more closely approach a truly "continuous" mining machine.

There is a trend towards a concentration of mining in both old and new mines. Operators have discovered that the operation of a number of mining units in a section has, in most instances, resulted in higher productivity at lower cost. However, this method of mining increases the burdens on the underground power supply. One company, for instance, has found it desirable to operate six mining units in one face entry section. Three of these units are continuous miners and three are conventional mining units. A chart taken from a graphic ammeter showed peaks of 2000 amp. This represented loads in excess of 1000 kw at 550 v. Feeders of large capacity are needed to provide acceptable voltage regulation for such heavy loads.

Below is shown the distribution system used by another large mining company to adequately serve four continuous mining units. It will be noted that considerable copper is used in this system.

There was a time when a borehole connection had a life of from six to eight years, but because of the rapid extraction effected by concentrated mining, the life of some boreholes may be reduced to as little as two or three years. Where power is distributed by means of high voltage feeders and underground conversion units, it may be necessary to move substations more frequently.

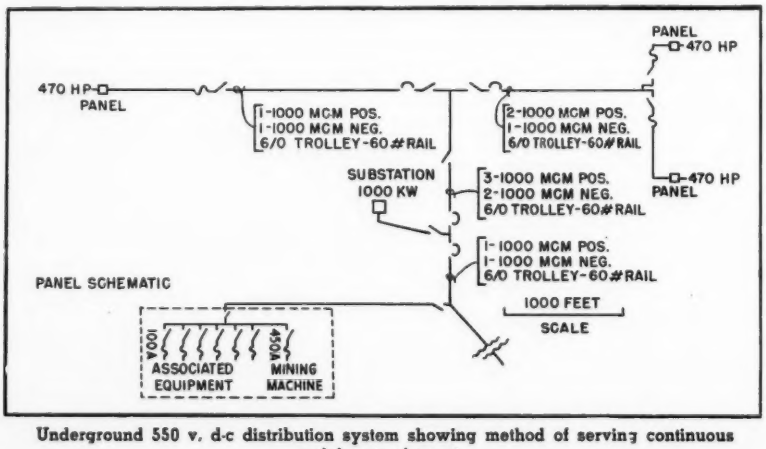


Typical transmission system for large coal mine (transmission voltage—25.000 volts)

Underground protective devices are being applied in approved application patterns in the modern coal mine. Note the underground devices installed in the mine distribution system shown in the figure below. There is a growing realization that circuit breakers are necessary for more than safety reasons. Interruption to the power supply in any section of the mine is costly, and for this reason, many companies are installing breakers to disconnect faulty facilities from the supply system without affecting the operation of other equipment.

Growing Interest in A-C Power

Most of the discussion thus far has dealt with d-c distribution systems, but there has been a growing interest in a-c equipped mines. Why all the interest in a-c power for coal mines? Is it the manufacturer who is promoting the use of a-c or is it the operator? There is evidence that both groups are tremendously interested in a-c distribution because they feel that alternating current will solve some of their problems. The manufacturer, for instance, believes that a-c equipment on continuous miners would result in an improved piece of equipment. The continuous miner at best is a cumbersome piece of equipment and manufacturers are constantly trying to reduce the size of this machine. An electrical engineer for one of the largest manufacturers of continuous miners tells me that space limitations are one of his most difficult problems. When it comes time to engineer the electrical equipment into a miner, the designer finds that he is hampered by lack of space. The a-c squirrel-cage motor, which does not have a commutator, requires less space than a d-c motor. Another feature which attracts the engineer to the a-c motor is the fact that silicon insulation has been successfully applied to a-c motors. This successful use of silicon windings in a-c motors has resulted



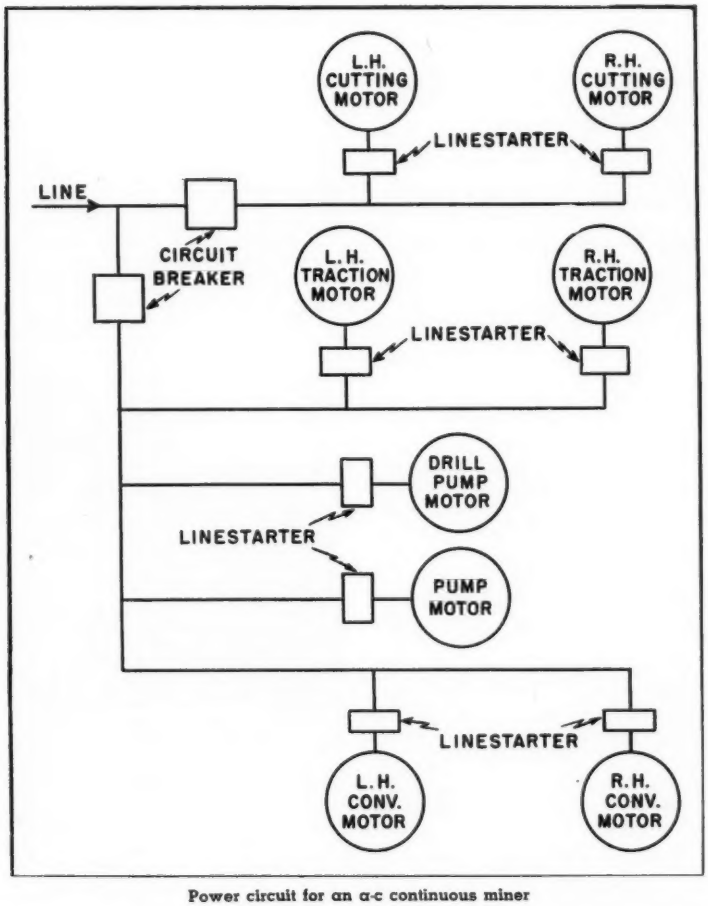
Underground 550 v. d-c distribution system showing method of serving continuous mining equipment

in still further increased horsepower to size ratios, with a corresponding reduction in space requirements. Because of its simplicity, a-c control equipment also requires less space. In figure below you will see the diagram for an a-c equipped continuous miner. You will note that the a-c motor control essentially consists of a circuit breaker and a line starter without the need for accelerating resistors or time-tactors. The manufacturer's electrical engineer also points out that the electrical equipment on the a-c miner is lower in cost than for the d-c equipped miner.

Now let us take a glimpse at the same problem from the operator's point of view. Why does the operator express an interest in this relatively new method of underground distribution? To begin with, some of the same features that interest the manufacturer also interest him. For instance, the operator is interested in lower cost equipment and he is also interested in a smaller, more maneuverable machine. In addition, the operator sees the possibility of decreased motor maintenance due to the inherent characteristics of the a-c motor and especially the elimination of commutator trouble. He also sees the possibility of decreased contactor trouble. This belief is substantiated by the fact that alternating currents are more easily interrupted than direct currents.

There are other advantages to alternating current in which the operator is interested, which involve the distribution system itself.

First Cost—The first cost of a-c portable power centers is lower than the first cost of portable rectifier substations. The cost of a ventilated power center is approximately 25 percent of the cost of equivalent conversion capacity.



Power circuit for an a-c continuous miner

Efficiency—A-c power centers are approximately 6.5 percentage points more efficient than rectifiers over the operating range from ¼ to 1¼ full load.

Flexibility—Portable power centers weigh approximately 40 percent as much as portable rectifiers and, consequently, can be more readily moved from one location to another and installed at less cost. A-c power can easily be transformed, making various voltages available at the face for lighting and portable power tools.

Safety—Safety resistance grounding schemes have been developed on a-c systems which limit machines to ground voltage to a safe level on ground faults. A 480-v, three phase a-c neutral grounded system results in only 277 v from phase to ground, which is comparable to a 275-v d-c system.

Reluctant to Adopt A-C

The advantages of alternating current have been apparent for many years. This being the case, why has the coal industry been reluctant to adopt the a-c distribution system and a-c operated mining equipment? The most important reason, of course, is that the d-c system for years has been a satisfactory system. The d-c system is capable of supplying both haulage and machine loads. The adoption of a-c would result in two underground systems which most mining people feel would be objectionable. Mining companies have considerable investment in d-c equipment and mine personnel are familiar with the operation of d-c motors and devices.

Coal mining people are also concerned about the ability of the a-c squirrel-cage motor to meet the necessary torque requirements at the face, especially under varying voltage conditions. The allowable limit on voltage regulation for a-c motors is plus or minus 10 percent. D-c motors will operate at 75 percent of rated voltage, but generally at the expense of production and maintenance.

Despite the drawbacks just mentioned, a-c power is actually being used by some coal companies and being considered by a number of others. Some companies are planning to experiment with a-c sections in present mines. Operators will watch with interest the experience of these companies.

Future Distribution Systems

Whether alternating or direct current or some combination of both will power the coal mine of the future, will depend upon how well each system can fill the fundamental requirements mentioned earlier in this paper. It is safe to say, however, that distribution systems in the future will be required to serve mining machines of increased horsepower ratings and larger electrical load concentrations with greater flexibility and more reliability than ever before. Underground distribution systems have been and will continue to be of increasing importance in the economical operation of the coal mine.

What Makes a Gypsum Deposit Economic?

* **An available market—Most gypsum goes into manufactured products for consumption in the construction industry**

* **Efficient operations—With a low-price product, minimum production costs are essential**

* **High quality—Competition demands a good grade of raw material and latest processing technology**

* **Adequate tonnage—The required size of a deposit depends upon its use**

By J. F. HAVARD
Vice-President Operations
Fibreboard Paper Products Corp.

GYPSUM is a modest mineral that lacks the glamour of gold or the lure of uranium. No wars have been fought for its control and no grand strategists built around its deposits. Nevertheless this useful industrial mineral is today being mined and processed on such a large scale and is the basic raw material for such great enterprises that it is attracting new interest.

The question can therefore be fairly asked: "What makes a gypsum deposit economic?"

Over 10,000,000 Tons Mined

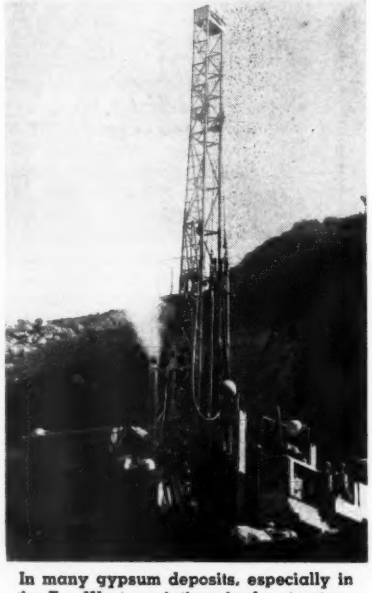
Let us first look at the production and usage figures. The U. S. Bureau of Mines reports that 10,573,000 tons of gypsum were mined in the United States in 1955 and that 4,064,000 tons were imported. The total supply was therefore 14,637,000 tons. Most of this output went into the production of 8,814,000 tons of calcined gypsum for further processing, but two raw or uncalcined uses were significant: 2,196,000 tons to portland cement plants as retarder and 687,000 tons to agriculture as soil conditioner. Industrial (non-construction) uses accounted for 299,000 tons of calcined gypsum in a variety of interesting and often highly-specialized applications.

The great bulk of gypsum, more than three-fourths of the mined output, goes through gypsum manufacturing plants and into the construction field. Over 3,000,000 tons of plaster were applied to the nation's buildings in 1955. This is a large figure but shrinks beside the output of lath, 2,927,000,000 sq ft, and of wallboard, 4,712,000,000 sq ft! Yes, the figure are billions—altogether nearly eight *billion* sq ft of gypsum board products! Several big gypsum board plants in the United States are each capable of turning out over 1,000,000 sq ft a day.

Gypsum is useful in such great quantities because of these principal characteristics:

- Large deposits in many geographical areas
- Low-cost quarrying and mining
- Low-cost processing because it is soft and non-abrasive
- Low heat requirements to change it into a cement by removing three-fourths of its combined water
- Wide range of control over its setting time, its casting and forming characteristics, and its final physical properties

Gypsum is a soft white mineral with its composition $CaSO4.2H_2O$. Commercial gypsum is found in massive beds associated with other sedimentary rocks. Common varieties which have negligible or no commercial use are selenite (flat transparent mica-type plates), satin spar (the fibrous type) and gypsite (mixed with clay and sand).



In many gypsum deposits, especially in the Far West, variations in the structure and quality make careful sampling a necessity

Anhydrite is often closely associated with gypsum and has the composition CaSO4. It is usually found at depth below the gypsum. It has only minor commercial value.

Unevenly Distributed

In the United States commercial gypsum is mined and processed by major companies in the following general areas:

Eastern Great Lakes region: western New York, northern Ohio and the lower peninsula of Michigan (also southern Ontario)

Indiana: southern section
Iowa: Fort Dodge area
Virginia: extreme western section
Southwestern belt: Kansas, Oklahoma and Texas
Rocky Mountain belt: all states but most useful in Montana, Colorado and Utah
Southern California and Nevada

No sizable commercial deposits have been found in New England, the entire deep South, the Minnesota-Wisconsin region, northern California, or the Pacific Northwest.

Major Imports

Large imports of crushed raw gypsum are brought into this country by ship from Nova Scotia to Atlantic Coast cities, from Jamaica and the Dominican Republic to Gulf Coast cities and from San Marcos Island in the Gulf of Lower California to Pacific Coast cities. Almost all of this tonnage is produced by wholly-owned subsidiaries of United States companies. Major imports in 1955 were as follows:

Canada (mostly Nova Scotia)	3,100,000 tons
Mexico (mostly San Marcos Island)	331,000 tons
Jamaica	61,000 tons
Dominican Republic	41,000 tons

Large Companies Are the Rule

All important tonnage of gypsum produced in North America is mined and processed by large integrated building materials manufacturers, particularly in this country by United States Gypsum, National Gypsum, Bestwall (formerly Certain-teed's gypsum enterprise), Celotex, Kaiser Gypsum (Permanente Cement), Blue Diamond and Pabco (Fibreboard).

The small independent producer can sometimes find a place for himself by supplying agricultural gypsum to a local area near a deposit (example: from gypsite deposits in Fresno and Kern Counties, Calif.). Sometimes he can obtain contracts to supply portland cement manufacturers (examples: from the Murfreesboro, Ark. and Winfield Dome, La. deposits). Special uses occasionally develop (example: local artisans turn alabaster figures from gypsum of the Front Range deposits north of Loveland, Colo.) But the day of the small independent plaster mill has passed, and the new modern gypsum board and plaster plants, costing from $3,000,000 to over $10,000,000 each, are now constructed only by the integrated corporations.

Costs and Prices Low

Agricultural gypsum is worth from about a dollar a ton for low-grade gypsite loaded on truck at the pit up to about $12 a ton for high-grade finely-ground gypsum in sacks f.o.b. cars or trucks. Portland cement retarder, crushed and screened, and mostly meeting standards of 90 percent purity or better, sells for $2.75 to $3.50 a ton on cars in bulk. Of course, some portland cement companies operate their own gypsum quarries.

The major companies obtain most of their tonnage from large quarry operations which utilize the best equipment and methods to strip, drill, blast, load, transport and crush gypsum for delivery to plant or railroad car. Operating costs are usually in the range of $1 to $2 a ton for this work. Underground mining is confined to locations where it can be done most effectively (as at Heath, Mont. and Medicine Lodge, Kan.) or where high cost is compensated by closeness to market (as in western New York).

J. F. HAVARD, vice-president operations for Fibreboard Paper Products Corp., is a mining engineer and geologist by way of Montana School of Mines and University of Wisconsin. He has had over 20 years' exploration and operating experience with United States Gypsum Co., Potash Company of America and Pabco. He was involved in the corporate wedding of Pabco Products Inc., building materials manufacturer, and Fibreboard Products Inc., producer of paperboard, containers and cartons.

In most locations, the gypsum is owned in fee by the producer. Royalty arrangements are rare and usually are 10 or 15 cents a ton where scarcity is a factor, as in western New York State. No royalty payments are made by a major producer anywhere in the Far West to my knowledge.

Rail freight rates for substantial regular movements of rock must be low to be competitive and usually range from one cent a ton-mile on long hauls to two cents a ton-mile on short hauls. Imported gypsum is hauled in ships of foreign registry at extremely low cost per ton.

Now all of this story means that there is a lot of gypsum in the United States, but that it is unevenly distrib-

Over 10,000,000 tons of gypsum were mined in the United States in 1955 with major companies obtaining most of their tonnage from large quarry operations

uted; that integrated companies with large investments are the rule, but that the small operator occasionally can find a place; that costs and prices are low, so that efficient operations and low freight charges are essential.

Examples Illustrate Economic Factors

Let's look at a few more examples. The sands of Alamogordo, N. M., are nearly pure gypsum but are not competitive because other deposits lie much closer to every sizable market. The deposit on Winfield Dome, La., is too small for a major gypsum product manufacturer but in the hands of an efficient independent operator has a useful role in supplying Gulf Coast cement plants. The former operations at Roswell, N. M., and Piedmont, S. D., are abandoned because these are too far from major markets and small remote plaster mills can no longer meet competition. Selenitic sands in California and Nevada have not been exploited for many years because the quality of the deposits cannot compete with the high-purity rock gypsum used in products manufactured for the Pacific Coast market. The deposits recently discovered at depth in southern Indiana meet a real need for gypsum to serve a vast population in the heart of the United States; two fine new integrated plants are now operating in the area and use rock mined underground. It is interesting to note that this find is one of the few important new discoveries of gypsum made in North America in recent decades.

Dangers Which a Prospector Must Consider

Impurities. The quality of a gypsum deposit is important. Generally speaking, it should run at least 85 percent pure gypsum to meet competition and in many areas it should be over 90. Careful formulation of wallboard core and plasters will compensate for lack of "casofours" but the ultimate in strength, in light weight, in aggregate-carrying capacity and in other desirable characteristics cannot be obtained below the nineties. For some special purposes the purities must be in the high nineties and the basic rock both white and dense. On the other hand, some California gypsite soil conditioner sells with purities as low as the fifties. A trend is beginning toward upgrading low-purity gypsum, say in the sixties, by heavy media concentration, in deposits with unique geographical value such as those in the vicinity of Port Clinton, Ohio.

In many gypsum deposits, especially in the Far West, sampling must be done with the same careful techniques used in sampling metallic ores. Too often even the experienced miner will have an analysis run on hand samples, ignoring such factors as interstratified limestone and shale, or the presence of a deceivingly high-grade secondary efflorescent mantle in desert countries, or the presence of shallow and extensive anhydrite.

Finished wall board—nearly eight billion sq ft of gypsum board products were manufactured in 1955

Tonnage. The required size of a deposit depends upon its use. If its purpose is to supply a small portland cement plant with retarder, even a few hundred thousand tons will be satisfactory in the right location. Most major producers feel they must have 5,000,000 tons in reserve to justify an integrated operation and prefer more than 10,000,000. A good-sized gypsum quarrying or mining operation will produce 1000 tons a day; a real whopper, such as the great quarries in Nova Scotia, will reach nearly 10,000.

Just as quality can be deceiving, so can tonnage. A well-known American geologist was deceived a few years ago and signed a report extrapolating tonnage at depth in a potentially useful deposit where anhydrite is known to be massive within 200 ft of the outcrop. He thus attributed about 20 times the possible available tonnage to the deposit and influenced the owners so that they still maintain a completely unrealistic idea of its value. There is no substitute for core drilling to locate the anhydrite subsurface contour, but experience helps.

Structural Problems. Another pitfall for the unwary is the extreme plasticity of gypsum under structural deformation. It is a source of joy to the academic structural geologist who sees his theories dramatized, but it is a headache to the engineer trying to determine tonnages of a deformed bed hidden by a mantle of alluvium or efflorescent material. Gypsum can be squeezed out completely between wall rocks on the limb of a fold, but may be bulged to several times its original thickness in the top or bottom of the fold. It is interesting to note that promoters have an uncanny aptitude for digging their prospect holes in the bulges and never touching the thin squeezed-out stuff between.

Subsurface Solution. Gypsum is relatively soluble, a fact which leads to another type of interesting problem for the prospector. Classical areas of potholing are found in some locations. In other places—for instance, the Fort Dodge area of Iowa—subsurface solution is hidden under level terrain and becomes a major factor in exploration. Even in the better Fort Dodge deposits, subsurface channels are a problem in stripping and quarrying; in other places, solution has removed so much of the gypsum bed that it is no longer useful or even present.

Conclusion

In summary then, these are the chief factors that must be considered in the evaluation of an economic gypsum deposit:

(1) An available market
(2) Low mining costs
(3) Cheap transportation to point of use
(4) Good competitive quality
(5) Adequate tonnage

Some of the dangers which must be considered by the prospector are.

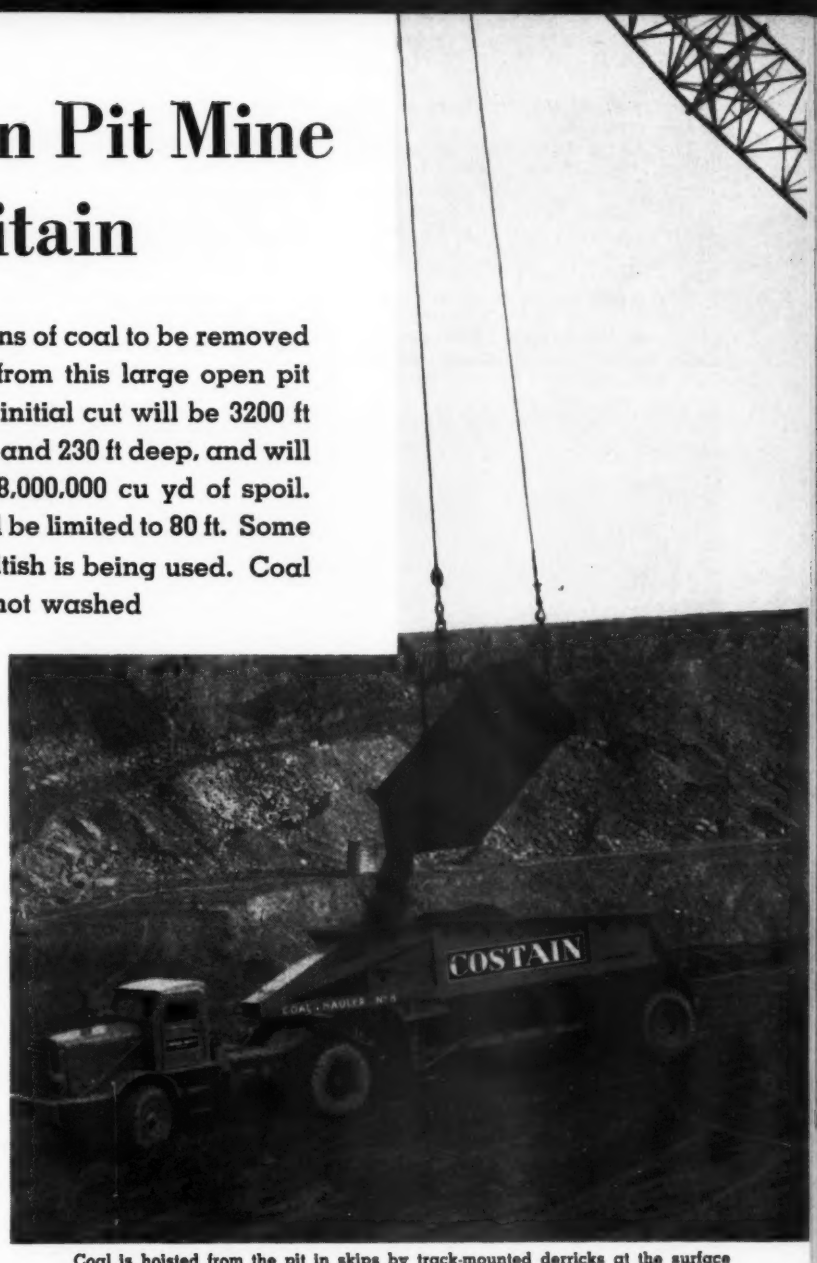
(1) Interstratified impurities
(2) Anhydrite
(3) Structural problems
(4) Subsurface solution

Given a potentially commercial deposit, the small independent operator can develop a profitable enterprise only if he understands the competitive pattern and finds a unique situation. He will be most likely to find such a situation in producing portland cement retarder or agricultural gypsum. Major companies still seek large gypsum deposits as reserves to back up existing operations or to obtain a geographical advantage.

Largest Open Pit Mine In Great Britain

Plans call for over 5,000,000 tons of coal to be removed within the next seven years from this large open pit project in Great Britain. The initial cut will be 3200 ft long, 100 ft wide at the bottom, and 230 ft deep, and will require the removal of over 8,000,000 cu yd of spoil. Widths of succeeding cuts will be limited to 80 ft. Some U. S. equipment as well as British is being used. Coal is screened but not washed

By R. J. SALTER
Consulting Engineer



Coal is hoisted from the pit in skips by track-mounted derricks at the surface

FOR many years now the National Coal Board of Great Britain has been obtaining coal by open pit mining. Many of the better deposits close to the surface have been worked out, and the coal is being obtained from greater depths. The product secured by stripping must be competitive in price with deep-mined coal, and to make this possible some of the larger items of earthmoving equipment have been obtained from the United States.

One of the largest sites being worked at the moment is the Acorn Bank area near the famous Roman Wall of Hadrian in Northumberland. Here Costain Mining Ltd., the contractor for the work, hopes to take out over 5,000,000 tons of coal within the next seven years—a weekly target of 16,500 tons. To recover this coal, overburden will have to be removed to a depth of 230 ft.

Geology

Three main seams of coal are to be found beneath the site. The High Main, a seam with an average depth of 3 ft 3 in., contains a band of shale with a thickness of one in., and the Top Grey consists of two bands of coal with a thickness of 2 ft 7 in. each. The Bottom Grey has four bands. Top and bottom bands are free from shale partings and have a thickness of 3 ft 1 in. and 2 ft 10 in. respectively, and the middle two have a thickness of eight in. each.

Vertical spacing between the various seams of coal varies considerably over the site to be worked. For instance, the vertical distance between the High Main and the Top Grey is 40 ft in the west while at the eastern boundary of the site the difference is only six in. In the same way the interval between the Top Grey and the Bottom Grey is only 15 ft in the northern area of the site, while at the southeast corner this increases to a maximum of 120 ft.

Maximum depth of the coal is in the northeast corner of the site where the Bottom Grey has a cover of 230 ft.

Geological conditions above the coal seams are mostly shales and sandstones, which are easily removed because they are broken. Between the ground surface and this harder material, 30 to 50 ft of boulder clay is to be found.

Method of Mining

While the open pit coal is being taken out, coal below the site is being removed by deep mining. This condition requires extreme care during blasting.

In a country as small as the British Isles, demands of industry and housing are decreasing the amount of agricultural land available for food production. Consequently, it is a condition of this and all other large open pit contracts that the land be progres-

sively returned to agriculture as the coal is removed.

This factor determined the method of working. It was decided to take out an initial box cut along the length of the eastern boundary of the site. With a length of 3200 ft and a width of 100 ft at the bottom, the cut will finally reach a depth of 230 ft.

Over 8,000,000 cu yd of spoil will be taken out of this cut before it is completed, the majority of this amount being hauled to a previously worked out site for forming a small hill to improve the drainage of the area. The rest is to be stored on the site for the back-filling of the final cut when the work is completed.

After the first box cut has been taken out and all the coal removed, parallel excavations will be made progressing from the eastern boundary towards the west. The width of the cuts after the first will be limited to 80 ft, material from the second cut being utilized to fill the first, and so on across the site.

Access for the coal hauling equipment to the bottom of the box cut had to be seriously considered. A long approach ramp could be constructed but this would have had to be progressively extended as the work proceeded and would have required a large area of agricultural land to be retained during the whole period of the work.

Another solution was a vehicular tunnel, but because of the fear of subsidence from the deep mine workings, the scheme was abandoned.

Finally it was decided to lay a temporary track along the top of the high face of the box excavation and use high speed electric derrick cranes to lift the coal to the surface where it would be transferred to the haulage vehicles.

The initial cut will finally reach a depth of 230 ft

Some U. S. Equipment Used

First operation on the initial base cut which is now being taken out was the removal of the top soil and 3 ft of underlying material. This work was carried out using five Super C Tournapulls of 12-yd struck capacity together with a Euclid Twin Power Scraper of 18-yd struck capacity. After this material, which will be used for surface restoration, had been removed, the excavation was taken down to approximately 100 ft below ground level by three Ruston-Bucyrus 120 RB shovels, with a bucket capacity of five cu yd.

Remainder of the overburden is being removed by the use of two draglines obtained specially from the United States for this work. The machines are Bucyrus-Erie 1150 B draglines, one fitted with a 180-ft boom and the other with a 215-ft boom. It is machines of this type which are making the production of open pit coal from such depths economical.

While the first box cut is being taken out, the draglines and shovels are loading a fleet of 22-ton and 15-ton Euclid rear dump trucks. As a protection against the spoil, one of the draglines is loading a 22-ton Euclid through a skid mounted hopper, but the other is loading directly into a rear dump using a 22-yd Hendrix bucket which gives some measure of protection to the truck receiving the discharge.

On the average the 22-ton Euclids are carrying 11½ cu yd and making between four and five round trips per hour on the 10,000 ft haul. The site roads are formed of a three ft thickness of broken sandstone and are kept in a good condition by the constant use of motor patrols. Two shifts are being worked and this has allowed a system to be maintained where the day shift traffic keeps to the right of the road and the traffic keeps to the left on the other shift.

Explosives Required

Once the upper geological drift had been removed, it was necessary to use explosives for the whole of the time. Three Joy-Sullivan 58 H rotary air-blast drills are being used for the drilling which has been established at 18 by 18-ft centers in the box cut area.

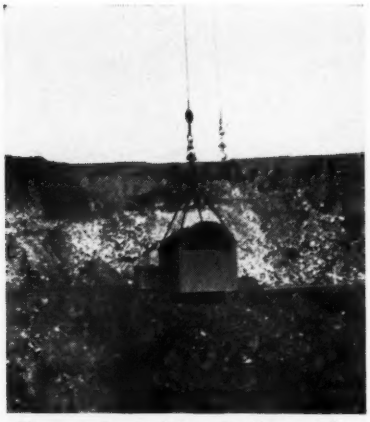
Explosives used are "opencast gelignite" and "999," both manufactured in Great Britain by Imperial Chemical Industries. One part of gelignite is being used to four parts of "999," which is an ammonium nitrate type explosive. At the moment a large amount of explosive is being used because of the restriction on rock movement due to the constricted nature of the box cut.

As the individual coal seams are reached, the seam is cleaned, usually by hand, and then loaded into the ten-ton capacity derrick skips by the Ruston-Bucyrus 120 RB electric shovels. The buckets, mounted on 152-ft jibs, are electrically hoisted and then dumped directly into the coal haulage vehicles.

1½-Mile Road Constructed

Open pit coal is not suitable for direct shipping to consumers and it must be passed through a coal screening plant. About two miles from the Acorn Bank site there is a previously constructed screening plant, and it is to here that the coal is being transported.

Coal from the open pit had to reach the screens along two miles of winding country lanes with steep gradi-



Men are lowered into the box cut by means of an electric derrick crane

ents. Another limitation on the haulage of the coal was the limit of 14 tons to the weight of coal which could be transported in any one load. A coal hauling vehicle which could also work on the site was required.

For these reasons the contractor decided to construct a new haulage road running directly from the site to the screens. Taking a more direct route than the existing road, the new haul road is 1½ miles long, has a 30-ft carriageway and a large amount of earth-moving was required to maintain uniform gradients.

Three Bailey bridges have been used in the road, one over the River Blyth and the other two carrying the haul road over existing highways. The bridge over the River Blyth is 190 ft long and is supported on timber trestles with decking of greenheart planking. The two bridges over the highways are each 120 ft long and are supported by reinforced concrete columns.

A necessary precaution is the guard screen fitted below these three bridges to catch falling coal.

Although construction of this road cost the contractor 100,000 pounds sterling, the saving in coal transport costs far outweighed this sum. The round trip from site to the screens and back now takes only 30 minutes, and when coal production is in full swing, a 40-ton load of coal will be delivered every 7½ minutes.

In the construction of the road over 50,000 cu yd of excavation were taken out, and hand stone fill totaling more than 100,000 cu yd was used in depths varying between 3 and 60 ft.

Order 60-Yd Trailers

With construction of the private haul road going ahead, an order was placed for eight bottom dump semi-trailers and four prime movers. Constructed in Great Britain, they are the largest made in the country to date and have a capacity of 60 cu yd or 40 tons of coal.

Built by the Eagle Engineering Co. of Warwick, the trailers have bottom dump doors opened by gravity and held in the closed position by cams, and a hand lever. Closing of the doors is by a hand wheel operated cable winch.

The body of the trailer is constructed of ¼ and 5/16-in. plates reinforced by steel angle and channel sections. Springing is not used on the back axle which carries four earth mover tires with an over-all diameter of 50 in. and are interchangeable with those on the tractor unit.

Hydraulic legs are fitted on the front of the trailer and are connected to the hydraulic pump on the prime mover so that a trailer may be uncoupled from the prime mover during the loading operations.

Power for the pulling unit is provided by dependable 270-hp Rolls Royce diesel engines. Over-all dimensions of the complete unit are length 50 ft, width 11 ft and height 12 ft, with an unloaded weight of 66 tons.

Power for the electrically driven equipment on the site is being obtained from the public supply at 20 kv and 50 cycles per second. Two 3000 kva transformers reduce the voltage to 3.3 kv after which it is transmitted by overhead line to the site. The two large draglines require power at 4.16 kv and 60 cycles per second, and so a part of the supply passes through frequency boosters.

Ash Reduced to Ten Percent

Screening of the coal is being carried out with the object of reducing the ash content of the coal to a uniform ten percent. As the coal is being mined, the ash content varies between 3 and 25 percent. Washing of the coal is not considered necessary as particular care is being taken to clean the coal seams of any spoil or dirt before recovery is commenced.

Coal Preparation

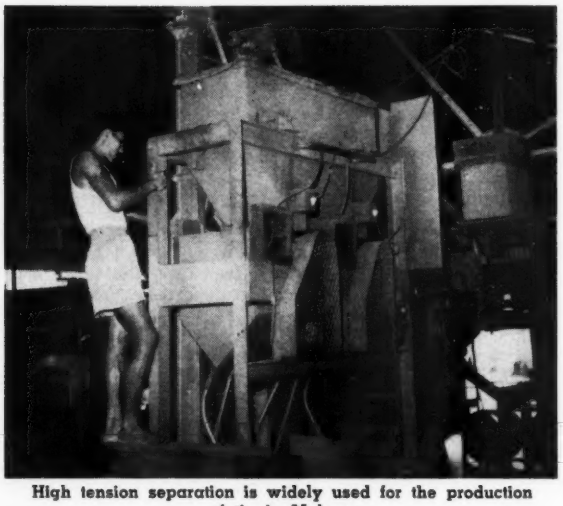
Coal is discharged from the trailers into one of three 12-ton capacity hoppers which feed onto the three main 36-in. coal transporters through Sherwen electric-magnetic variable feeders. Each of these three belts can handle up to 150 tph of coal.

These belt transporters discharge over "Niagaras" or vibrating screens. The larger coal goes to picking belts where low-grade material is removed by hand and passed to storage before being taken back to the site for dumping.

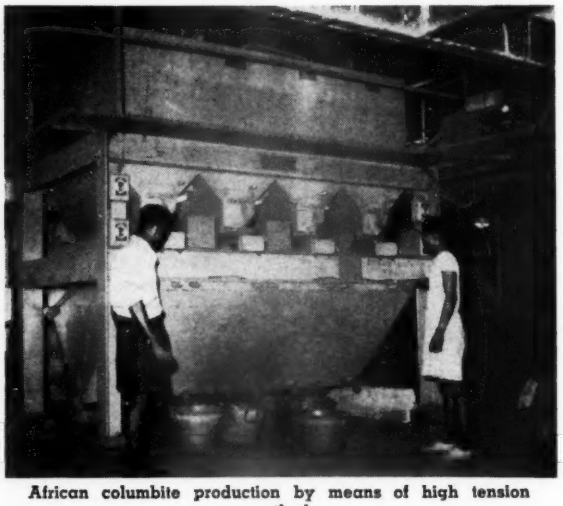
If this hand picked coal is of good enough quality, it is then passed to boom loaders which can load directly into road or railway transport. Should coal be of poor quality after leaving the picking belts, it is passed through Jeffrey-Diamond crushers to under two in. size after which it is mixed with high quality coal which has passed through the "Niagaras."

As the contract is larger than the usual open pit operation and the time for completion is seven years, a modern brick office and administrative building has been erected on the site. This building is the head office of Costain Mining Ltd., a subsidiary of the civil engineering contractors Richard Costain Ltd. which has been formed to carry out the contract.

Three Bailey bridges have been used in the 1½ mile haulage road that was constructed between the open pit site and the screening plant. The one in the foreground is 190 ft long and is supported on timber trestles with decking of greenheart planking



High tension separation is widely used for the production of tin in Malaya



African columbite production by means of high tension method

High Voltage and Magnetic Separation

Research and development are making high voltage and magnetic separation methods important tools in the ore dressing field

By J. HALL CARPENTER
Partner
Carpco Research & Engineering Co.

THE combination of specific gravity, high voltage, and magnetic separation methods has been applied successfully to beach sands for the recovery of titanium, zirconium and associated minerals for some time. This same combination of ore dressing methods is now finding use in the production of many other minerals all around the world. It is the purpose of this paper to summarize the high voltage and magnetic techniques now in world-wide use but which are not now generally understood. Some of the techniques now in the development stage are listed in the accompanying chart to indicate the trend of the future use of electrical and magnetic separations for mineral beneficiation.

High voltage and magnetic techniques can each be classified into two general fields: High voltage into fields, one where no current flows; and one where current does flow. Magnetic separations may be classified as either low intensity or high intensity. A chart has been prepared to show this classification, to show the general principle used, the type of equipment used, and the separation typical of those now being successfully made.

In most cases, high voltage and magnetic separation are performed after concentration by either specific gravity methods or flotation; and in most cases, these final separations are performed with material in the dry state. During the past few years, there has been increased activity to perfect more separation techniques in the wet state, especially in the field of high intensity magnetic separation.

High Voltage—Static Fields

Separations of minerals in the electrostatic field is by far the oldest method of high voltage separation, and because of this nearly any separation made with the use of high voltage is still referred to as electrostatic. In all the research, engineering and mineral production that has been done in the past ten years, it has become obvious to most people working in this field that an entirely different type of separation is obtained in high voltage fields where current is allowed to flow. Most of the commercial separations taking place now in plants throughout the world employ equipment where current does flow across the field. Very little has been done during these ten years except in research toward the commercial use of separation by employment of truly electrostatic fields.

In electrostatic fields, it may be stated in general that a separation can be made between any two non-conducting minerals that can be given charges of opposite sign, or that take on different degrees of charge of the same sign. It is therefore obvious that any specific combination of these minerals may be separated in a field of this type. It should be pointed out, however, that in the majority of cases, the separation may not be complete, may be technically complicated and may have no commercial value. Minerals may obtain a charge on their surface by a number of ways. They may become charged by contact potential between grains or any surface they may touch, by heat and/or friction or by an action of induced elec-

trical charge. Minerals carry many differences which, when introduced into the electrostatic field, will behave differently. They may be attracted or repelled from the electrodes or attracted or repelled to varying degrees. An interesting combination of these effects may be obtained by alteration of the surface characteristics of the material by various coatings such as may be obtained from flotation reagents, salts, gases, and so forth.

The basic form of electrostatic separator is merely a charged field set up between two plates. The minerals are introduced into the field by dropping them between the plates and separation is effected according to any surface charge which they may possess. It should be noted that in this type of separation, any sharp point or anything else that will allow a discharge of current across the separation field is completely disastrous to the separation. The effect of any current that flows is so much stronger than that of the surface charge on the minerals that any separation that depends on surface charge is virtually impossible.

There are other types of separations using the electrostatic principle besides those using plates. For example, rotor types such as used by Bullock wherein the electrode is in the form of another rotor which is at a high potential but does not discharge. These rotors are usually used in series in a vertical position. Another form of this type of separator is the multiple chute, sometimes called "toboggan type" wherein the minerals slide down over a series of cascaded chutes through various electrostatic fields. This process has been used in India and Australia for many years. It might be noted that in the chute type machine, any appreciable amount of current flow will usually stop the separation due to the fact that the minerals will be pinned to the trough on which they are moving, thereby impeding the flow of material.

Some of the separations which have been made successfully in electrostatic fields, and particularly in the plate type separators, are given in the chart. In general, quartz can be separated from nearly any other mineral. In some separations, shape plays a very important part. This is particularly true in the case of separating asbestos fibre from the parent rock. Tests made on the separation of asbestos fibre have indicated that the fibre length can also be controlled by the separation. It should be noted that all of the minerals listed as typical of this method of separation are considered non-conductors in a high voltage field with current flowing, and are normally the ones that are pinned to the rotor in a high voltage current field and, therefore, there is no way to separate them by the high tension methods.

There is an ever increasing need for mineral beneficiation methods in the smaller particle sizes. This is particularly true in the radioactive mineral field. It is the writer's opinion that preferential precipitation of these fine minerals by electrostatic methods may eventually prove to be the answer to this problem.

High Voltage—Current Flow

High voltage separation with a current flowing field has become more widely understood during the past 15 years. It became obvious that the separations performed in a high voltage field where current was flowing were entirely different from those affected in the electrostatic field where no current flows. A number of words have been coined to describe this type of separation. The writer had originally used the words "high tension" to describe this type of separation, and this expression has come into general use. Other words describing the same effect have been used, including electro-dynamic, convective charging and others.

This type of separation has a fairly simple principle. The minerals are conveyed into a field where a high voltage discharge is taking place. The conveyor is usually a rapidly spinning rotor. The minerals which conduct electricity to a degree do not obtain enough surface charge to affect them appreciably, and therefore, travel off the rotor at a normal trajectory. Minerals which are non-conductive, however, do take on a strong surface

Pilot plant testing is a prerequisite to sound plant design

charge and are usually pinned by this charge to the rotor. They follow the rotor around and are brushed off. If sufficient current discharge is allowed to pass between the electrode and the rotor, and the rotor speed is slow enough to allow the materials to be charged to the fullest, then nearly all materials can be pinned to the conveying rotor. As the rotor speed is increased or the discharge to the rotor lessens, then materials which are conductive and therefore discharged to the rotor are thrown off the rotor first. Whether the material is considered a conductor which is thrown off the rotor or non-conductor which is pinned to the rotor is, therefore, a relative matter. In general, however, for practical separations, the pinned or non-conductor materials include all the silicates, phosphates, calcites, etc. The materials which are thrown off the rotor and are classed with conductors include all the metallics and many of the oxides and sulphides.

The most common type of equipment used for high tension separation is of the rotor type. Separators without moving parts are not amenable to this type of separation as the material is pinned to whatever surface it is on and, therefore, this surface must be moving to keep the material moving. Other types of separators are built using belts and rotating discs as the conveying medium.

This type of separation has been practically universal in its application in connection with the separation of the minerals obtained from beach sand deposits. It is now being applied to a very large extent to separation of other minerals including cassiterite, scheelite, columbite and many others.

In high tension separation, it should be noted that unlike the electrostatic separation, polarity has little or no effect. The minerals to be separated are normally hot and dry so that moisture coating does not adversely affect the separation. However, the temperature is not critical as it is in an electrostatic work where the surface charge characteristics of the minerals may be very critically affected by temperature. It is interesting to note that during this last year in plants using high tension separation, it has been found that minerals could be taken directly from salt water and separated successfully without a fresh water wash. They are separated at a temperature high enough to completely dry out the salt. This does not mean that it is not very desirable to remove coatings of grains but that sometimes they can be tolerated.

Research work presently being carried on at Carpco Research and Engineering has indicated that there is an interesting field of separation in high tension fields due to the shape of the particles such as in the separation of micaceous flakes from materials which are basically round in shape. There is a strong sizing affect in this type of separation and some work has been done in sizing in high tension fields for such materials as ground glass and others which are difficult to screen.

There is a possible future development in a type of separation which can be classed as electrical with current flow. This is in the field of electrophoresis where fine particles are precipitated or practically plated out of solution. Electrophoresis may show some possibilities in the separation of super fine materials as described previously as a possible use of preferential precipitation.

Magnetic—Low Intensity

Low intensity magnetic separations are, of course, in very wide use in many forms and in nearly every mineral separation plant. The field strength used for low intensity work can usually be obtained by modern magnetic alloys such as the Alnico series.

Magnetic separators of the low intensity type take many shapes and forms. Probably the most common separator of this type is the magnetic pulley which is used for the removal of magnetic contamination such as tramp iron, welding refuse, etc., and is used to separate magnetite where it occurs in a small quantity.

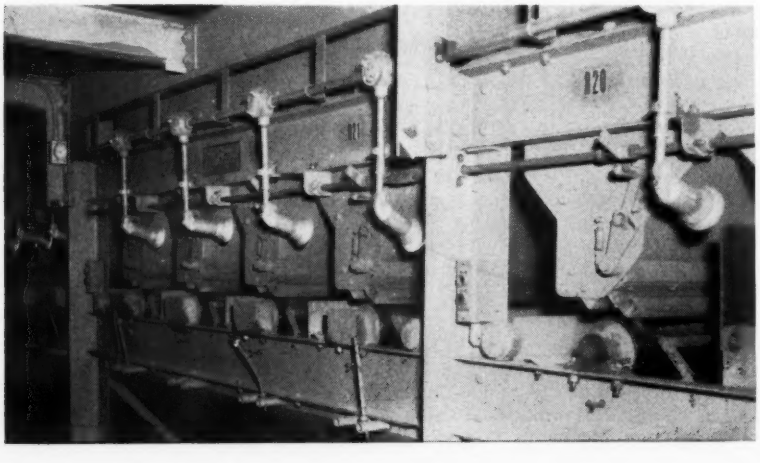
Many interesting separations have been made during the past few months at Carpco Research and Engineering by separating the magnetic particles merely by rotating or moving the magnetic field rather than by use of any

J. HALL CARPENTER attended Georgia School of Technology and New York State College of Ceramic Engineering, graduating as a ceramic engineer. He later studied electronic engineering through Cornell University Extension and is a licensed mining engineer.

Carpenter was associated from 1940 to 1943 with the Titanium Alloy Manufacturing Co. of Niagara Falls, N. Y., doing mineral separations research and industrial in-

strumentation. During 1943-1946, he was technical superintendent for the construction and operation of the Rutile Mining Co. of Florida. From 1946 to 1948, he was plant engineer of the Humphreys Gold Corp. and during this time designed the dry separation plants producing titanium and zirconium minerals for E. I. du Pont de Nemours & Co. from the Trail Ridge deposits at Starke, Fla.

In 1948 he formed Carpco Engineering and Manufacturing Co. to develop and manufacture equipment to produce and beneficiate various materials. Carpco now consists of five different companies. These companies are a closely integrated group comprising of research and engineering, equipment manufacture, plant construction, and export.



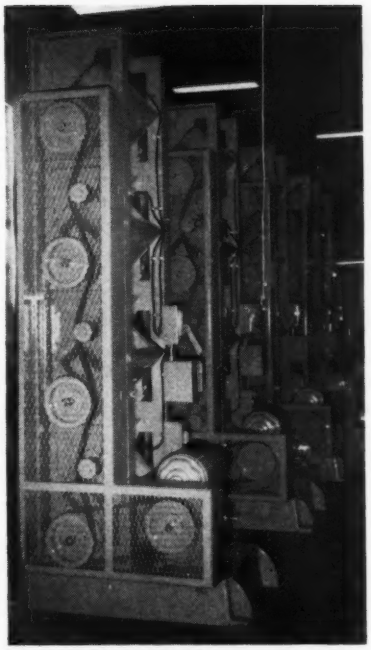
Electrical separators are now equipped with automatic controls to assure optimum production. Research and development are rapidly perfecting high voltage and magnetic techniques

conveying device. This type of separation is referred to as rotating field magnetic separation and has a strong advantage in the fact that no moving parts come in contact with material being separated. This type of separation has been successfully applied commercially during the past few months and it has now proven to be interesting as a development of equipment for use under water. It is interesting to note that the magnetic field strength of this equipment is actually stronger under water than in the air. This type of separator should prove valuable for the removal of highly magnetic material previous to drying and in heavy media separation.

Magnetic—High Intensity

The strong fields, which may be classed as high intensity, are nearly always created by electro-magnets. Very high concentration of flux can be obtained with magnetic alloys; however, the design required limits the capacity of such equipment such as to make it commercially unimportant. By far, the type of equipment in largest use for high intensity work is the induced roll magnetic separator. The rotor type equipment gives the largest throughput of material for the amount of equipment employed and allows highest flux densities. Flux density up to 176,000 magnetic lines of force per sq in. of area of the rotor over which the mineral is affected is obtained commercially.

The second largest group of high in tensity separation units are those



Group of four-rotor high intensity magnetic separators ready for shipment to mining operations

which separate the minerals by lifting them to a pole piece so shaped as to give convergence of lines of force. This type of separation is used because it can be used to separate minerals of comparatively small differences in magnetic susceptibility, while the rotor types are generally more suited to separating magnetic from non-magnetic materials. Examples of this type of separators are Cross Belt and various rotating disc types such as the French SIME and the Malayan McLean. The writer has developed a high intensity induced roll magnetic separator which has a lift type action. Units of this type are being used commercially in Australia and may find more applications.

Low intensity magnetic separation is limited practically to tramp iron, magnetite and some highly magnetic iron ores. All other minerals showing any magnetic susceptibility could be classed as separable by high intensity magnetic separation. As new types of separators are developed making use of higher flux densities, other minerals also formerly considered non-magnetic can be added to the list of those which can be separated by this method.

During the past few years, there has been a very keen interest and a lot of development work carried out in the field of high intensity wet magnetic separation. The writer has reports of successful separations of this type in the United States and also in Australia and Germany. At the present time, however, the cost and size of this type of equipment, in comparison to its capacity, appears to limit its use. This is, however, an important field which will no doubt be developed.

Research and development are rapidly making high voltage and magnetic separation methods important tools in the ore dressing field.

CLASSIFICATION CHART

High Voltage and Magnetic Separation Methods

Mining
Preparation
Concentration

CLASSES	HIGH VOLTAGE		MAGNETIC	
Type	Static Fields (Electrostatic)	Current Fields (High Tension)	Low Intensity	High Intensity
General Principle	Charged field used to preferentially attract minerals (usually non-conductors)	Electrical discharge pins non-conductors (silicates) to conveying medium. Allows conductors (oxides and metallics) to pass freely.	Weak fields generally from permanent magnets.	Strong fields generally from electro-magnets.
Typical Equipment	Plates (primary type) Rotors Discs	Rotors (primary type) Belts Discs	Pulleys (primary type) Drums Plates	Induced Roll (primary type) Cross Belts Discs Rings Deflection
Typical Separations	Feldspar-Quartz Halite-Sylvite Soda Spar-Potash Spar Barite-Quartz Asbestos-Serpentine Apatite-Quartz	Molybdenite-Biotite Cassiterite-Scheelite Rutile-Zircon Columbite-Monazite Chromite-Garnet Tantalite-Microlite	Removal of Magnetite Tramp Iron Ferrous oxides	Bastnasite-Barite Biotite-Muscovite Wolframite-Scheelite Leucoxene-Rutile Ilmenite-Chromite Monazite-Sphene
Future	Preferential precipitation of superfines	Sizing and shape separations. LOW VOLTAGE Electrophoresis	Rotating fields Wet and dry.	Wet high intensity separations.

Maintenance and Operation of

Study by Committee on Coal Preparation details money-saving maintenance and operating practices at 20 coal preparation plants

MECHANICAL cleaning of coal has increased tremendously in the United States over the past quarter century. The U. S. Bureau of Mines reports that in 1929 only 6.9 percent of the coal production was cleaned mechanically while in 1955, 60.0 percent was so cleaned.

It is not so widely realized that the growth in cleaning the smaller coal sizes has grown even more rapidly, especially in recent years. As the demand for lump coal fell off and demand for stoker and smaller sizes grew, interest in fine coal cleaning technology increased. Markets opened up for coal sizes that had formerly been wasted. Competition between coal suppliers, and the need for a uniform fuel product by large consumers also grew. These factors combined to make the rise in fine coal cleaning sharper than the already steep climb of mechanical cleaning. This use in fine coal cleaning has been accompanied by a parallel growth in fine coal drying.

With this as a background, the Committee on Coal Preparation of the American Mining Congress has investigated maintenance procedures being followed by several coal producers to keep mechanical drying equipment in operation. In an effort to show the industry ways in which it can improve mechanical drying equipment performance through the presentation of case histories, data has been collected from 20 operations covering several seams of coal. The information was secured by questionnaire and has been tabulated in Table 1. Dryers have been arranged according to types for better comparison.

Mine A

Ten mechanical drying units are operated at this cleaning plant. Approximately 45 tph of ⅜ in. by 0 coal from the Number 2 Gas, Dorothy, Cedar Grove and 5 Block seams are fed to each unit. Moisture content of the feed varies from 27 to 29 percent and the product contains from 8 to 8½ percent moisture. It is estimated by plant personnel that 20 percent solids remain in the effluent, all of which is returned to the raw coal feed. Eleven cyclones are employed in desliming ahead of mechanical dryers.

A complete set of 24 screens per unit will last 60 days—870 operating hours—without any maintenance other than cleaning and checking every day. After that time attention has to be paid to patching holes in the screens. Designating the screens as top, middle and bottom; the top screens (with patching) will last 1740 hours; the middle screens (with patching) will last 2610 hours; the bottom screens (with patching) will last 3480 hours.

A spare machine is kept on line for emergencies. The major item of delay time is caused by oversized coal, which may come from leaky screens, that plugs the dryer.

Forty-eight top screens, 36 middle screens, and 24 bottom screens are kept in stock and are reordered as they are used. In addition, there are two sets of reflector plates, one set of ribs, one top bearing, one bottom bearing and assorted studs, etc., kept on hand. This may seem a small inventory for ten units, but this is accounted for by the fact that the cleaning plant is so located that all parts are easily and quickly obtainable from a supplier. A plant not so admirably located would of necessity have to stock more heavily.

A completely built-up spider or spinner is installed every 45 operating days and is replaced approximately 14 months later.

Mine B

From 25 to 40 tph of minus 5/16-in. Pittsburgh seam coal is fed to each of the mechanical dryers at this cleaning plant. Moisture content of the feed varies from 15 to 20 percent, and the average moisture content of the product is 10.4 percent. Effluent contains 34 percent solids. These dryers operate 13 hours a day, and from 12 to 15 hours a month are spent for maintenance on each dryer.

A screen life of from 125 to 150 hours (4800 tons) is reported as is a basket life of two years. A spare machine is carried on line for emergencies. Major items of delay time are caused by changing screens and ribs.

The company stores screens, wear plates, bearings, etc., in the minimum amounts for its requirements. As part of the maintenance program, each dryer is taken out of service at regular intervals and the basket rebuilt and all worn parts changed or repaired.

Mine C

This plant has 18 dryers on line, each handling from 30 to 40 tph of ¼ in. by 0 Pittsburgh seam coal. Moisture is reduced from 19-28 percent in the feed to 8.6-9.6 percent in the product. Solids in the effluent ranges from 30 to 40 percent.

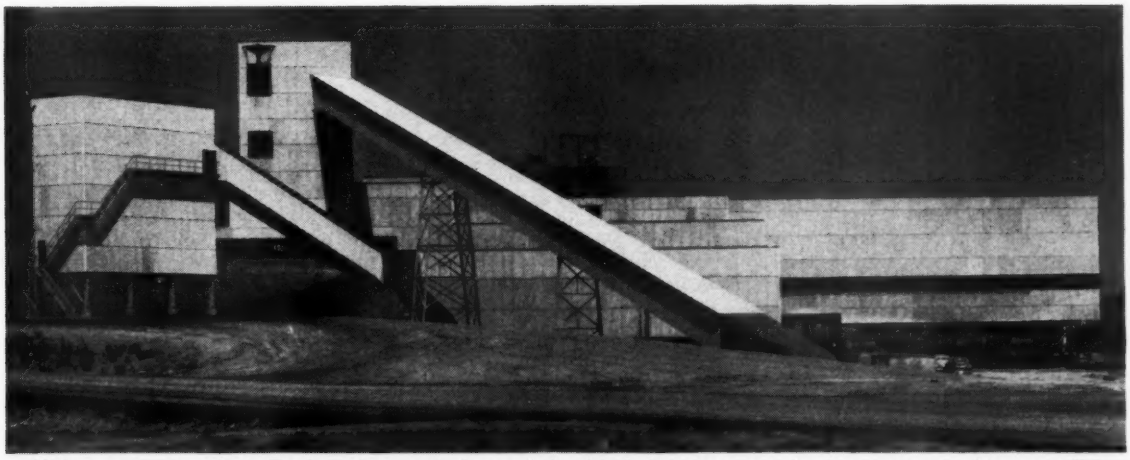
Dryers are operated 14 hours per day at a speed of 400 rpm with 40 hp being delivered to each unit. Eighty-four hours of maintenance time are spent on all units for each 280 operating hours (one month). The maintenance program calls for a complete overhaul of two dryers each month, and inspection of each machine every shift. The 84 hours includes rebuild time. Enough spare parts are stocked to completely overhaul four of the 18 dryers on line. Screen life is reported as: top row, 192 hours; middle row, 280 hours; bottom row, 948 hours.

Major item of repair time is changing screens, although no delay is involved as this is done as a phase of the regular maintenance program.

Mine D

From a feed of 60 tph of ⅛ in. by 0 (Hernshaw seam) at a moisture content of 22 percent, a product of seven percent moisture is obtained. Thirty-three percent solids in the effluent is reported. Sixty hp is delivered to a unit, driving it at 400 rpm. A screen life of 120 hours is reported. A spare machine is on line for emergencies. No delays are reported. A spare bas-

Mechanical Drying Equipment



Modern preparation plant—The large increase in fine coal cleaning during recent years has been accompanied by a parallel growth in fine coal drying

ket, 12 extra sets of screen plates, a shield, and a wear ring are kept in the supply room. Regular daily cleaning and checking of units is done with screens being changed every 90 operating hours. The ⅛ in. by 0 is deslimed at ½ mm ahead of centrifuges.

Mine E

Mechanical dryers at this cleaning plant are fed 60 to 65 tph of minus 5/16-in. Pittsburgh seam coal. Moisture content of the feed varies between 16 and 18 percent with the product containing 6.5 percent moisture. There is 20 percent solids in the effluent. Dryers are operated 17 hours daily on an average, and 15 hours monthly are spent for maintenance on each unit. The company reports a screen life of 50 hours and does not have a spare machine. No major down time is reported except to change a rotor and wear plates about once a year. In the spare parts department, a complete set of major repair parts for one dryer is kept in stock.

About every 3½ years the dryers are given a major overhauling. New gears, bearings, grease and shafts are replaced when necessary.

Four years ago the vibrating feeders were installed on each drying unit. These give an even feed and the major repair to the mechanical drying units has been reduced by one-half.

Mine F

The upper Freeport seam is cleaned at this plant. Three-eighths-in. by 0 sized coal is fed at the rate of 55 tph with a feed moisture of 25 percent to each dryer. This gives a product of 7.6 percent total moisture and 6.8 percent surface moisture. The percent solids in the effluent is 26-32. Units are operated 15 hours a day. Power input is 60 hp and speed of operation is 750 rpm.

Approximately 25 man-hours per month are spent for maintenance, exclusive of screen replacement which takes about 32 hours. Normal screen life is 37.5 hours. A spare unit is kept on line. Items of delay time are listed as: feed chute plugged due to overload; and breaking of the shear pin on conveyor due to overload or plugged discharge chute. At least one of each part is kept in stock and worn parts are replaced before trouble starts. Worn baskets are now being built-up rather than being replaced with new ones.

Mine G

Three screen type dryers are used on coal from the 5 Block, Chilton, and Cedar Grove seams. Feed size is 5/16 in. by 0 at a rate of 60 tph. Moisture content of the feed is 23 percent and of the product, seven percent (includes one percent inherent moisture). The effluent carries 15 percent solids. Dryers are operated 22 hours a day on a power input of 60 hp and run at 715 rpm. Approximately 25 man-hours per month per unit are used for maintenance. An expected screen life of 80 hours is maintained.

A spare machine is on line for emergencies. Items of delay time include: screen replacement; flight replacement; bevel gear and basket replacement, and cleanout under machines. A full supply of all parts is kept in inventory. The maintenance program includes: proper lubrication; checking load factor; replacing of worn parts before trouble starts; periodic inspection of gears and bearings; and cleanout of machine after end of shift. All of these steps have acted to reduce dryer maintenance costs.

Mine H

The Sewell seam is mined. Feed to the dryer is ⅝ in. by 0 at a rate of 20 tph, recovered from the jig settling tank only. Moisture content of feed is 29.5 percent, and 8.4 percent moisture is maintained in the product. There are 5.5 percent solids in effluent. The unit is operated 7¼ hours per day with a 50-hp motor driving the unit at 728 rpm.

This plant shows a screen life of 108-120 hours and a bowl life of 15 months. No spare machine is carried. Major item of delay time is in replacing screen cloth due to wear. Spare parts carried in inventory are: dryer cloth and scrapers, and one extra bowl with new cloth is kept in the warehouse. Screen cloth is changed when oversize coal shows in the effluent.

Mine I

This screen type dryer processes 45 tph of ⅛ in. by 0 Illinois No. 7 coal at 41.3 percent total moisture (27.3 percent surface and 14.0 percent seam moisture). Moisture in the product is 18.5 percent (4.5 percent surface). There is approximately 13.3 percent solids in the effluent. The dryer operates seven hours a day at a speed of 765 rpm, being powered by a 65-hp motor.

Approximately 22 hours a month

are devoted to maintenance. Screen life is reported as 42 hours. No spare machine is on line. An exceptionally low percent of delay time is reported —four hours in the past year. Spare parts kept on hand are: one rotor; a three months' supply of screens; one set of flights; one set of wear plates; one spare basket, and a clamping ring. Bearings are purchased locally as needed. Preventive maintenance tends to lower dryer costs, the company concludes.

Mine J

This plant dries the ⅛ in. by 0 from the Lower Cedar Grove seam at rate of 35 ± tph with a feed moisture content of 25-30 percent. Product moisture is ± seven percent. Solids in the effluent amount to ± 22 percent. Dryers are operated 14.5 hours per day by a 60-hp motor. Eighteen hours per month are spent on each unit for maintenance. A screen life of 60-70 hours is expected. No spare machine is kept on line for emergencies.

Little delay time is experienced. Spare parts as recommended by manufacturer are stocked, and units are checked regularly and repaired as needed.

Mine K

Three-eighths in. by 0 coal from the Pittsburgh Seam is dried in this plant at a rate of 55 tph per unit with a moisture content of 17.2 percent. After processing, the product is maintained at 5.84 percent moisture. Solids in effluent are kept at 15.3 percent. Each dryer is operated 12 hours per day, driven by a 60-hp motor at 750 rpm. Twelve hours per month maintenance is required and the screen life expectancy is 70 hours. A spare machine is kept on line for emergency. The only item of delay encountered is on the oil pump. One basket, spare screens, one oil pump, a concave wear ring and one set of scraper blades are carried in stock. Routine inspection and repair as needed is included in the maintenance program.

Mine L

The Bradshaw Seam is prepared at this plant. Size of feed to dryer is ⅛ in. by 28 mesh and is fed to the dryer at a rate of ± 50 tph. Moisture content of the feed is ± 25 percent and that of the product is ± seven percent. Percent solids in effluent is ± 21 percent. Each dryer is operated 14.5 hours per day and is driven by a 60-hp motor. A screen life of 140-200 hours is expected. No spare machine is kept for emergencies. A daily check is made and repairs are made as needed. Parts recommended by manufacturer are kept in stock.

Mine M

This company mines the Pittsburgh Seam and dries the ⅜ in. by 28 mesh coal at a rate of 85 to 90 tph. Moisture content of feed is 15 percent which gives a product moisture of 4.50-5.00 percent. Solids in the effluent amount to 42 percent. Seventeen hours per month per unit are devoted to maintenance. Fifty to 60 hours is average screen life. No spare machine is kept for emergencies. Spare parts are: basket and screens. The maintenance program consists of regular lubrication and replacing screens as needed.

Mine N

From a feed of 50 tph of minus ¼-in. Pittsburgh seam coal at 28 percent moisture (surface), a product with a moisture of 7½ to 8 percent (surface) is maintained. Dryers are operated 22 hours per day. Units are operated at 750 rpm with power from a 60-hp motor. Approximately 60 hours per unit per month are used for maintenance. A spare machine is on line for emergencies.

Seventy hours of screen life can be expected. Major items of delay time are: screen changes; bearing failure—caused by lubrication failure; and damaged baskets, caused mainly by foreign steel or tramp iron. Sufficient parts to cover repairs are maintained.

Changes that have been made in the dryers since installation include:

(1) Changing the oiling system to a force feed reduced oil use 82.5 percent, lowered operating temperatures, curtailed the pitting of gear teeth and eliminated lubrication failures. (Pressure switches and gauges were tied into the electrical circuit.)

(2) Additional area was added to the bearing area of the center shaft, reducing bending stresses.

(3) Improvements were made in the throat of the machine to even out feed.

(4) The use of alloy steel in all shafting increased the life of units.

(5) Flights on the dryer cap were made replaceable and fabricated from heat-treated alloy for better wear.

(6) Cone flights are made of alloy steel and heat treated.

(7) Baskets are made in the plant shop with stainless steel rod as the main body. These cost ⅙ as much as stainless steel baskets from the original manufacturer.

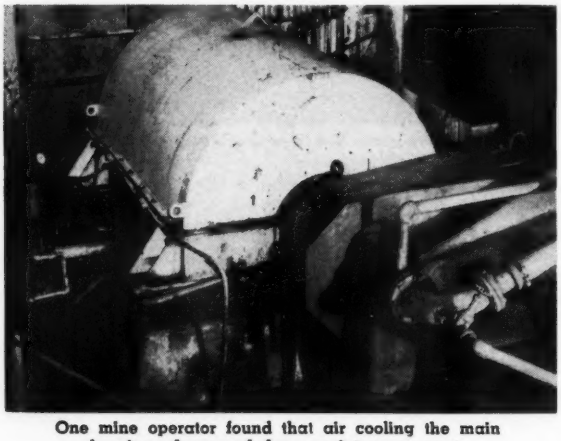
(8) Rotors are faced with special rod to give long life on wearing surfaces.

(9) The frame of each machine is lined with hard concrete (special mix) to improve life at impact points where coal leaves the rotor.

(10) Proper maintenance instructions are given mechanics.

(11) Periodic inspections are used to facilitate planned repairs.

(12) Complete gear units are assembled ready for replacing worn out units, and housed in dirt-proof boxes.



One mine operator found that air cooling the main bearings decreased dryer maintenance costs

These six centrifugal dryers are a vital part of the drying procedure in the preparation of coal fines at a plant in Ohio

(13) Power cranes on a track over the dryers take all load off workmen and speed repairs.

Mine O

Feed of ⅛ in. by 0 from the Pocahontas No. 3 seam is fed dryers at the rate of 25 tph at feed moisture of 70 percent. From this feed, a product moisture of 11 percent is obtained with six percent solids in the effluent. A 75-hp motor drives the unit at 650 rpm.

Screw life is reported as one year. Bowl life is up to two years with the original bowl still in use. The major cause of delay is overload. Spare parts are listed as feed pipe, spare screw, spare bearings, and spare seals. The maintenance program includes a daily inspection, and a 30-minute lubrication and an oil change every 2000 operating hours.

Mine P

The upper Chilton seam of coal is prepared at this cleaning plant. Approximately 60 tph of 9-mesh by 0 coal is fed to each dryer. Moisture content of the feed is 40 percent and moisture content of the product is 12.5 percent. Eight percent solids are reported in the effluent.

Each dryer is operated 14½ hours per day. There is no delay time other than replacing screws after approximately 1150 hours' use. This work is done on week-ends. One spare screw, one spare motor, one spare set of gears, shear pins and bearings are carried as spare parts. As part of the maintenance program, the mechanical drying equipment is completely checked and overhauled quarterly.

Mine Q

This bowl type dryer is fed ¼-in. by 0 Clintwood coal at a rate of 60 tph. A moisture of 60-65 percent in the feed is reduced to 10-11 percent in the product with 10-12 percent solids in the effluent. The unit is operated 24 hours a day by a 200-hp motor at 865 rpm. Approximately eight hours a month is spent on maintenance. Screw life is reported as 2880 hours, and bowl life as five years. No spare machine is kept on line. Major item of delay time is replacing or repairing planet gear bearing. It is felt that these bearings are too small. One complete set of spare parts is kept in inventory. Weekly inspections are maintained, and dryer costs have been cut by air-cooling main bearings.

Mine R

The Lower Cedar Grove, ⅛ in. by 0, is dried at a rate of ± 50 tph with a moisture content in the feed of 50 percent. Product moisture is maintained at ± 14.5 percent with the amount of solids in effluent maintained at five to six percent. Dryers are operated 14.5 hours per day. A 150-hp motor drives each at 620 rpm. A screw life of 1350 hours and a bowl life of 13,000 hours (Conical section only) may be expected. No spare machine is on line for emergencies. Spare parts stock is one spare screw and one spare gear reduction unit. The screw is replaced when 65,000 tons ± have been dried—other parts are checked and repaired at the same time.

Mine S

A sized feed of ¼ in. by 0 Pittsburgh coal at a rate of 40 tph and a moisture of 78 percent is used at this plant. Surface moisture of the product is maintained at 12.5 percent. There is 2.5 percent solids in the effluent. The dryers are operated at 540 rpm by a 150-hp motor for 21¾ hours per day. A screw life of 2250 hours is maintained. A spare machine is on line for emergencies. As the spare unit is placed in use, extra parts are ordered.

Mine T

This solid bowl type dryer dries the High Splint -B-C seam of coal. The ¼ in. by 0 feed goes to each unit at the rate of 54 tph and a moisture content of 65 percent. A product of 6.5 percent surface moisture is maintained with 3.5 percent solids in the effluent. Each dryer is operated 24 hours per day. A 150-hp motor drives the unit at 540 rpm. A screw life of 2750 hours is expected. A spare machine is kept on line.

Table I—Operating data from 20 mines using mechanical drying equipment

	TYPE 1		TYPE 2							
Seam of Coal Washed	MINE A #2 Gas, Dorothy, Cedar Grove, 5 Block	MINE B Pittsburgh	MINE C Pittsburgh	MINE D Hernshaw	MINE E Pittsburgh	MINE F Upper Freeport	MINE G 5 Block, Chilton, Cedar Grove	MINE H Sewell	MINE I Ill. #7	MINE J Lower Cedar Grove
Size of Feed	⅜x0	5/16x0	¼x0	⅛x0	5/16x0	⅜x0	5/16x0	⅜x0	⅛x0	⅛x0
Rate of Feed (TPH)	45	25–40	30–40	60	60–65	55	60	20	45	35±
Moist. of Feed	27–29%	15–20%	19–28%	22%	16–18%	25%	23%	29.5%	41.3%	25–30%
Moist. of Product	8.0–8.5%	10.4%	8.6–9.6%	7%	6.5%	7.6%	7%	8.4%	18.5%	7%±
Solids in Effluent	20% (Est)	34%	30–40%	33%	20%	26–32%	15%	5.5%	13.3%	22%±
Hours/Day Operated	14½	13	14	18	17	15	22	7¼	7	14.5
Power to Dryer (HP)	40	40	40	60	60	60	60	50	65	60
Speed of Oper. (RPM)	383	400	400	400	600	750	715	728	765	—
Maint./Unit/ Month (Hrs.)	26	12–15	84	—	15	57	25	—	22	18
Spare Unit	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No

	TYPE 3				TYPE 4					
Seam of Coal Washed	MINE K Pittsburgh	MINE L Bradshaw	MINE M Pittsburgh	MINE N Pittsburgh	MINE O Poco. #3	MINE P Upper Chilton	MINE Q Clintwood	MINE R Lower Cedar Grove	MINE S Pittsburgh	MINE T High Splint B-C
Size of Feed	⅜x0	⅛x28M	⅜x28M	¼x0	⅛x0	9Mx0	¼x0	⅛x0	¼x0	¼x0
Rate of Feed (TPH)	55	50±	85–90	50	25	60	60	50±	40	54
Moist. of Feed	17.2%	25%±	15%	28%	65%	40%	30–35%	50%±	78%	65%
Moist. of Product	5.84%	7%±	4.50–5.00%	7.5–8.0%	11%	12½%	10–11%	14.5%±	12.5%	6.5%
Solids in Effluent	15.3%	21%±	42%	—	6%	8%	10–12%	5–6%	2.5%	3.5%
Hours/Day Operated	12	14¼	—	22	17	14½	24	14½	21¾	24
Power to Dryer (HP)	60	60	—	60	75	150	200	150	150	150
Speed of Oper. (RPM)	750	—	—	750	650	—	865	620	540	540
Maint./Unit/ Month (Hrs.)	12	—	17	60	3	50	8	—	—	—
Spare Unit	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes

Titanium Ores

—The Present Picture

Typical strip mining operation for rutile and zircon from beach sands, New South Wales, Australia

Titanium is not only the ninth most plentiful element, but there are many workable deposits in both this country and other parts of the world. Here is a review of major titanium deposits with emphasis on the factors that make them economic. Important uses for titanium are also outlined

By RICHARD QUIRK
Assistant Manager
Mining Department
National Lead Co.

THE rapid growth of the titanium pigment industry over the past decade, together with a steadily increasing demand for titanium metal, has created worldwide interest in new sources of titanium bearing ores. Since it is one of the most widely distributed of the elements, and the ninth most plentiful, prospectors from nearly every state in the union and from nearly every country in the world can find some titanium bearing, or pseudo-titanium bearing material in the area to capture their imagination and energy. This, together with titanium metal in sponge form being today quoted at $2.75 a lb, caused considerable misunderstanding and confusion in the minds of many regarding the value of the various titanium bearing rocks and minerals. Titanium sponge is pure titanium metal resulting from the reduction of rutile or a titanium rich slag. In this form it is melted and hot rolled for fabrication into the various forms that it is used. Prices for the principal ores of titanium, ilmenite and rutile are quoted daily in E&MJ Metal and Mineral Markets. The value of a particular ore is governed by its purity (titanium dioxide content), and, under certain circumstances in the case of rutile, its time of delivery. The prices quoted refer to mineral concentrates, so that the ilmenite and rutile in the crude ores in the ground are worth very much less.

Deposits Classified

Of the world's total production of ilmenite, nearly 99 percent of this production is used in the manufacture of titanium pigments. Approximately one half of the world's output of rutile is today used for the production of titanium metal. The remainder is used in the manufacture of welding rod coatings and in the ceramic industries.

In broad terms titanium deposits may be classified into two types: (a) Rock deposits and (b) beach sand or placer deposits. Each type may be exploited for ilmenite or rutile with other valuable mineral by-products. Beach sand deposits usually contain ilmenite, rutile, zircon and monazite in varying proportions according to the locality.

Major Rock-Type Ilmenite Producers

Rock deposits are important producers of ilmenite, usually with a salable iron ore by-product. At the present time approximately 57 percent of

the world's total ilmenite production comes from massive or rock-type deposits; the remainder is furnished by sand deposits principally from India.

At its MacIntyre Development at Tahawus, N. Y., National Lead Co. mines and treats an ilmenite-magnetite ore for the production of ilmenite and magnetite. This operation has been the world's largest producer of ilmenite since 1942, and reserves for the future are abundant. The Lac Tio deposit, at Allard Lake, Canada, owned and operated by the Quebec Iron and Titanium Corp., is an ilmenite ore associated with hematite.

The Storgangen Mine of the Titania A/S in Norway, an affiliate of National Lead Co., treats an ilmenite-magnetite ore for the production of ilmenite and magnetite.

There is an important difference between the amenability to beneficiation between the various rock titaniferous ore types. The Tahawus and Storgangen ores respond to gravity, magnetic separation and/or flotation procedures. The Allard Lakes ores are amenable only to a smelting process which produces iron and a titanium rich slag. Where the ilmenite is intimately locked with magnetite or hematite, the ore is usually classed as a direct smelting ore. All such ores have not been proven to be amenable to treatment by any process.

Apart from the Otanmaeki ilmenite deposit in Finland, the three deposits cited above represent the major rock-type ilmenite producers within the Free World at the present time. A large number of other occurrences are known, but have not been thoroughly investigated.

Economic Factors Noted

The size of a titanium bearing deposit, its location, grade and amenability to beneficiation, are all vital considerations in determining its value. Of particular importance is its suitability for the manufacture of titanium dioxide pigment. Ores have to be thoroughly tested in this regard before their true value can be determined. The presence of minor amounts of such elements as manganese, chromium, etc. in an ilmenite can preclude its use as a pigment raw material. This narrows the field of known economic deposits down considerably.

RICHARD QUIRK was educated in Australia and received his early training and mining experience in that country. He was associated with the chromite mining industry in New Caledonia for a number of years and made a comprehensive survey of the island for rutile and other minerals in the early 1940's. Prior to joining National Lead

Co. in 1951, he was superintendent of the Morococha Division of the Cerro de Pasco Corp. in Peru. His first assignment with National Lead was to carry out an exploration program for rutile and other minerals in Australia and the Pacific. He has been assistant manager of the mining department with headquarters in New York since 1953.

Sand Deposits Yield Rutile and Ilmenite

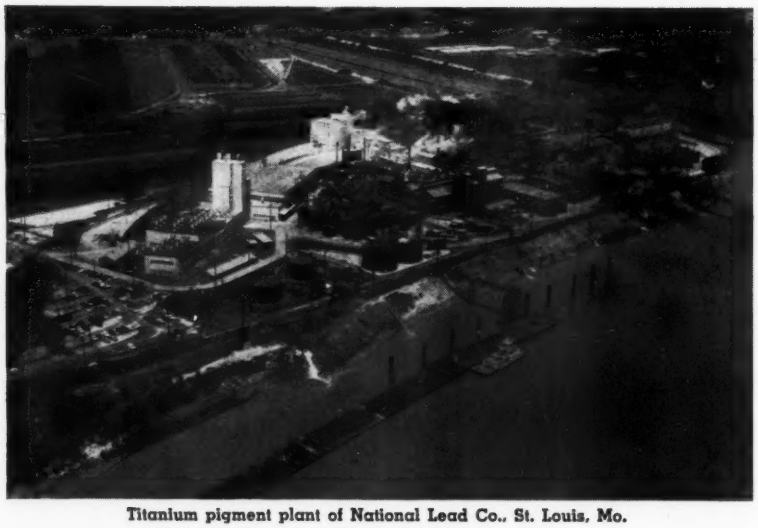
Economic titanium bearing sand deposits have been and are still responsible for a large proportion of the world's rutile and ilmenite production. Rutile, associated with ilmenite, zircon, monazite and other heavy minerals, is found in concentrated seams and usually interbedded with more recent sand deposits on many beaches throughout the world. Also, these minerals are found associated with pleistocene beaches inland from present day shore lines. Of less importance are rutile occurrences in residual and alluvial gravel placers along dry streams, as in Ceara and Goyaz States, Brazil, and elsewhere. During the war years a small amount of rutile was produced from these areas, but their grade and geographical location have retarded their full scale development to date.

At Travancore, India, in excess of 300,000 tons of high-grade (60 percent TiO_2) ilmenite is now produced annually from beach sand deposits. These sands contain up to 70 percent ilmenite. The greater part of Indian ilmenite production is exported to the U.S.A. and Britain and is consumed by the titanium pigment industry.

Largest Supplier of Rutile

In Australia, raised beaches and sand dunes contain economic rutile and zircon deposits which occur intermittently along the eastern coast of the continent and currently place Australia as the world's largest supplier of rutile. About one half of this mineral is now used in the manufacture of titanium metal. Due to the presence of deleterious elements, particularly chromium, no by-product ilmenite is used in the manufacture of titanium pigment, except from the Perth area in western Australia. Two types of deposits are recognized: (a) Deposits formed by marine action and (b) aerolian deposits or those formed by the action of wind. The latter are usually low-grade occurrences on the slopes of high sand dunes. At Stradbroke Island off the coast of Queensland, sand dunes up to 600 ft high contain concentrations of 1.8 percent heavy minerals on their southeastern facing escarpments. These accumula-

Huge rotary kilns perform a necessary step in the production of titanium oxide pigments at National Lead Company's Sayreville, N. J., plant. Titanium pigments are used to whiten and brighten paints, paper, rubber, plastics, floor coverings, inks, shoe polish and many other materials



Titanium pigment plant of National Lead Co., St. Louis, Mo.

A typical spiral separation plant operating on Australian beaches

National Lead Company's MacIntyre Development, Tahawus, N. Y.—Open pit mine at left shows 105-ft benches on footwall limit of the pit and 35-ft working faces on lower levels

tions have been formed as a result of wind action, and the rutile content of the heavy mineral fraction averages 30 percent. The deposits will be exploited by a large processing operation now under construction.

Marine deposits are formed by the alternate raising and lowering of the sea level throughout various periods of geologic time and consequent alternate shore elevation and erosion. During times of shore erosion, the heavy minerals, originally brought down by stream action from decomposing hinterland igneous rocks (acid and basic intrusive masses seem to be the most likely sources), are further concentrated and classified by wave action into concentrated seams. Subsequent elevation of the continental shelf or lowering of the sea level closes the cycle. The seams are then buried beneath sand accumulations, formed by wind action as the new shore-line builds up.

Changes in the elevation of the sea level in relation to the shore results in shore erosion and starts the cycle again, resulting in even a greater degree of concentration of the heavy minerals. Seams of concentrations below the dunes in some of the Australian deposits contained as much as 80 percent heavy minerals, of which 25-30 percent is rutile.

Determining Value

The value of beach sand deposits, apart from their geographical location, depends mainly upon: (a) Their rutile content, (b) the suitability of their contained ilmenite as pigment plant feed, and (c) value of by-product minerals such as zircon and monazite. Florida sand deposits produce a number of economic products such as rutile, ilmenite, zircon and monazite.

The value of a beach sand deposit also has to be judged on its individual characteristics. Many grades and types of ilmenites may be found along the various beaches of the world. A deposit may have a very high heavy mineral content but still be valueless because the contained heavy minerals are unsuitable for industry.

Samples from titaniferous deposits are first of all assayed for their total TiO_2 content. A mineralogical examination follows to determine the difference mineral species present and their relation to each other. This examination enables an initial classification of the ore to be made—whether it is a free milling ore amenable to ordinary gravity and magnetic beneficiation methods or a direct smelting ore. Ilmenite product is tested as regards its suitability for pigment manufacture. Rutile is examined for its suitability in the manufacture of welding rod coating, for titanium metal production or other possible uses. Without this information the economics of a deposit cannot be calculated.

1957 Coal Show

Industry Making Final Plans for Big Meeting

IT won't be long now until thousands of mining men from all over the world begin to converge on Cleveland, Ohio. They will be going there to attend the 1957 Coal Show of the American Mining Congress which will be held in Cleveland's Public Auditorium May 13-16.

Theme of this year's meeting is "Coal Builds a Better America," and as the opening date of the big four-day meeting draws closer, exhibitors are putting the final touches on equipment displays and program speakers are polishing up the papers they will present during the convention sessions. The Advance Program, printed below, reflects the careful work of the Program Committee in arranging the technical program. Building on a firm foundation of experience, speakers of high caliber will report on latest advances in deep and strip mining as well as coal preparation and the problems of management and safety. In addition, a two-day Conference on Industrial Minerals is being held for the many producers of industrial minerals who traditionally attend the Coal Show.

Over 240 manufacturers of mining equipment, supplies and machinery for use in the nation's coal mines will send exhibits to Cleveland in May. Not only will they take up all of the Public Auditorium's huge inside exhibit halls, but the equipment display will overflow into a large outside area. Many exhibits will feature full-sized machines in operation—some of them being revealed to the public for the first time—and equipment engineers and technicians will be on hand to answer questions about the machines on display.

Besides the many coal mining men who will gather in Cleveland for the Coal Show, there will be a great number in attendance from the metal mining and industrial minerals fields. They will be there because most of the equipment on display has direct application to their problems as well as to coal's. The technical papers given in convention sessions, although authored primarily by coal men, will contain much of value to the non-coal miner. But as a special service—and an innovation at the Coal Show—a Conference on Industrial Minerals is scheduled, covering subjects of particular appeal to these men.

The Coal Convention and Exposition is devoted to serious business, but it also has its less serious side. The traditional Coal Miners Party will be held on Wednesday evening. A special time for fun and relaxation, the party will feature masters in the art of entertainment and a well known dance orchestra.

There will be no formal entertainment on Monday, Tuesday or Thursday evenings; these have been left open for the entertaining and parties that are so much a part of the fun and good fellowship of Coal Show week.

Ladies also are cordially invited to come to Cleveland May 13-16. They will be most welcome at the convention sessions and are urged to visit the exposition with its many colorful

(Continued on page 79)

Preliminary Program

MONDAY—MAY 13

10:00 am—Continuous Mining

Maintenance of Continuous Mining Equipment—Compares former maintenance methods with the present revised organization and procedures, showing reasons for the changes and the advantages that have resulted.

J. H. Sherrard, Jr., Chief Engineer, Johnstown Coal & Coke Co., Portage, Pa.

Design of a Power Installation For a Continuous Operation—A resume of experiences and recommendations based on several years of DC and AC operation with conventional and continuous mining equipment.

W. C. Wright, Superintendent of Maintenance, Kaiser Steel Corp., Sunnyside, Utah.

Roof Support Without Interrupting the Continuous Loading—Describes a technique designed and successfully used at this mine for supporting roof at the face without delaying the operation of the continuous machine.

Benjamin Tudor, Mining Engineer, Clinchfield Coal Company, Clarksburg, W. Va.

Current Roof Support Practices With Continuous Mining—Roof support is always a major problem and particularly in continuous mining. The paper will show methods used with several types of machines in various roof conditions.

R. D. Joseph, Mining Engineer & **E. M. Thomas,** Mining Engineer Roof Control, U. S. Bureau of Mines, Washington, D. C.

TUESDAY—MAY 14

10:00 am—Conventional Mining

Mechanical Mining In Thin Seams—Describing the No. 3 Elkhorn Mine in Eastern Kentucky showing present system and possible variations, including development, recovery and the auxiliary operations correlated into the face cycle.

R. M. Johnson, Manager Rockhouse Division, Island Creek Coal Co., Ragland, W. Va.

Underground Rail Haulage Systems—Two speakers from different fields will give accounts of modern underground transportation with mine cars of large capacity and cars of medium capacity operating at high speeds.

Large Capacity Mine Cars

John R. Palin, Chief Engineer, Harmar Coal Co., Library, Pa.

High Speed Operation

C. S. Winters, Superintendent, Powhatan Mining Co., Powhatan Point, Ohio.

All-Belt Haulage and AC Power Underground—The DeKoven mine which was recently opened in Western Kentucky, has installed the most modern equipment for the face operations and the underground haulage.

Courtney Quirey, Superintendent, Pittsburg & Midway Coal Mining Co., DeKoven, Ky.

(Session continued on next page)

Maintenance—A Tool For Increased Production—Preventing machine breakdown is a major contribution to maximum tonnage and this paper will outline the methods and procedure of a successful maintenance organization.

C. N. Van Houten, Superintendent Maintenance, Tennessee Coal and Iron Division, U. S. Steel Corp., Fairfield, Ala.

10:00 am—Coal Preparation

Water Clarification—A Symposium to Cover Three Objectives.

Recovering Fine Coal of Commercial Value—An operator will describe an installation that reclaims coal from breaker slush and a manufacturer will discuss the several types of coal recovery equipment.

E. M. Robinson, Preparation Superintendent, Jeddo-Highland Coal Co., Jeddo, Pa.

Wm. C. McCulloch, Coal Preparation Manager, Roberts and Schafer Co., Chicago.

Conserving Water For Re-Use—A complete account of the washery water closed circuit system at Robena Preparation Plant, showing equipment, flow sheet, quantity of water treated and percentage recovered for re-use.

P. L. Richards, Manager, Coal Preparation, and

John C. Durfee, Superintendent Robena Plant, Coal Division, U. S. Steel Corp., Pittsburgh, Pa.

Preventing Stream Pollution—Two speakers will deal with this subject, telling what has already been accomplished in eliminating solids and acid mine water from discharges into streams and recommending what further is needed.

Henry F. Hebley, Research Consultant, Pittsburgh Consolidation Coal Co., Pittsburgh, Pa.

Larry Cook, Executive Vice-President, Ohio Reclamation Assn., Cadiz, Ohio.

2:00 pm—Strip Mining

Drilling and Blasting Overburden—Two papers will describe blasting with two types of explosives, showing character and depth of overburden, the complete system of drilling, hole spacing, sequence of firing and results in cost and yardage.

With Ammonium Nitrate Explosives

Fred Horne, Peabody Coal Company, Evansville, Ind.

With Liquid Oxygen

C. C. Woolsey, Drilling & Shooting Supt., The Enos Coal Mining Co., Oakland City, Ind., and

D. W. Mogg, Project Supervisor, Great Lakes Carbon Corp., Morton Grove, Ill.

Overburden Removal—A symposium by three speakers covering operations with different types of earth moving equipment, showing thickness of the coal character and depth of overburden, general plan of the strip pit, daily yardage of earth moved and tons of coal loaded.

Large Shovel Operations

T. G. Gerow, Mining Consultant, Chicago, Ill.

Small Shovel Operations

F. E. Dougherty, Vice-President Operations, Tasa Coal Co., Pittsburgh, Pa.

Tractors and Scrapers

Harry H. Hughes, General Superintendent, J. Robert Bazley, Inc., Pottsville, Pa.

WEDNESDAY—MAY 15

10:00 am—Conventional Mining

Major Factors in Belt Conveyor Haulage—Two speakers will outline the physical and operating conditions where belt haulage is best suited for main line and intermediate service, discussing the effect of grades, tonnage and belt speed.

J. W. Bassett, Mining Engineer, West Kentucky Coal Co., Madisonville, Ky.

Robert E. Spoerl, Chief Belting Engineer, U. S. Rubber Co., Passaic, N. J.

A Shop School For Maintenance Instruction — A completely equipped machine shop, planned and built as a maintenance instruction school, is training young men in the operation, construction, and rebuilding all types of mining machines.

W. C. Schott, Vice-President, Stonega Coke & Coal Co., Big Stone Gap, Va.

Special Problems In AC For Underground Power—Showing how AC relieves limitations encountered with 250 v dc and discusses the suitability of AC motor characteristics to certain types of mining loads.

C. C. Conway, Electrical Engineer, Clarkson Manufacturing Co., Nashville, Ill.

Core Drilling For Airshafts and Manways—This subject, of high interest to coal mining, will be covered by a description showing size of shaft, depth, rate of sinking, and yardage handled.

D. C. Ridenour, Olga Coal Company, Coalwood W. Va.

10:00 am—Strip Mining

Portable Power Systems for Strip Mining—A coal operator will describe installations and experiences in Indiana and Illinois while a maufacturer will be more general in outlining practices in other fields.

L. E. Briscoe, Electrical Engineer, Ayrshire Collieries Corp., Indianapolis.

B. E. Rector, Manager, Mining Engr. Dept., Westinghouse Elec. Corp., East Pittsburgh.

An Engineering Approach to Rehabilitation of Large Castings—Modern heavy stripping equipment has its special problems when repairs are needed. This paper describes a new technique for field repairs on large castings and forgings.

R. L. Rectenwald, President, Maintenance Engineering Corp., Pittsburgh, Pa.

Rope Life Extended By Maintenance and Proper Use—Proper care and maintenance for wire rope used on shovels, draglines and other strip mining equipment, will be outlined together with recommendations for rope inspection, lubrication and repairs.

B. N. Carlson, Chief Wire Rope Engineer, American Steel & Wire Div., U. S. Steel Corp, Cleveland, Ohio.

New Maintenance Ideas—A compilation of practices at a number of strip mining operations in several states will show methods used for preventing breakdowns and for quick repairs.

Emil Sandeen, Mine Superintendent, Pittsburg & Midway Coal Mining Co., Hallowell, Kans.

2:00 pm—Management-Safety

Mine Fire Hazards and Fire Fighting Equipment—Discussing fire hazards in coal mining, describing fire extinguishing equipment and outlining a plan for a fire fighting organization.

J. F. Whittaker, General Superintendent, Pittsburgh Coal Company, Library, Pa.

United Mine Workers' Role In Accident Prevention—Mine safety requires a complete cooperation between management and labor and this paper will outline how the mine workers contribute toward the reduction of accidents underground.

C. B. Ferguson, Director, Safety Div., United Mine Workers of America, Washington, D. C.

Personnel Evaluation and Training—Describes a personnel-testing program that has resulted in the selection of employes who are qualified and happy with their jobs.

C. R. Nailler, President, Christopher Coal Company, Osage, W. Va.

Cost Controls Through Industrial Engineering—After four years' experience with industrial engineering, this company is now planning some changes in their methods. The paper will explain the proposed changes and the reasons for making them.

G. W. Lockin, Industrial Engineer, Inland Steel Company, Wheelwright, Ky.

2:00 pm—Industrial Minerals

(Program to be announced.)

THURSDAY—MAY 16

10:00 am—Continuous Mining

Service Haulage for Continuous Mining—A Symposium Describing Operations with Several Types of Equipment.

Belt Turning Device—A new type belt conveyor designed especially for continuous operation and so constructed that it will convey around 90 degree curves.

W. G. Kegel, Assistant Master Mechanic, Vesta-Shannopin Div., J. & L. Steel Corp., California, Pa.

Bridge, Chain and Belt Conveyor—A complete system of service haulage, having a bridge conveyor from the machine to a chain conveyor which loads to the gathering belt.

Gordon A. George, Superintendent, Wyatt Seanor Coal Co., Eskdale, W. Va.

(Session continued next page)

Shuttle Cars—Describes the service haulage from the face to the intermediate haulage showing how seam height, grades, roof and bottom affect the shuttle operation.

Michael M. O'Brien, Assistant Superintendent, Pocahontas Fuel Co., Pocahontas, Va.

Mining in Various Seam Conditions—Two speakers will show how continuous mining is operating successfully in difficult as well as in more favorable seams.

Ray M. Biggs, Electrical Engineer, Viking Coal Corp., Terre-Haute, Ind.

William Laird, Superintendent, Eastern Gas and Fuel Associates, Grant Town, W. Va.

10:00 am—Coal Preparation

Modern Cleaning Plant Design—A discussion by two speakers on modern trends in coal preparation to meet anticipated market demands.

Loy A. Updegraff, Project Engineer, Bituminous Coal Research, Columbus, Ohio.

Jack M. Bishop, Chief Chemist, Truax-Traer Coal Co., Ceredo, W. Va.

Coal Drying and Dust Collection—A complete description of the Lynnville Preparation Plant, giving particular attention to the drying operation which has proven highly successful in reducing the moisture from washed coal.

A. P. Massman, Coal Preparation Manager, Peabody Coal Co., St. Louis, Mo.

Coal Cleaning with the Feldspar Jig—A type of equipment that has found wide use in Europe but is comparatively new in the United States will be described, including the character of the feed and the final product.

E. R. McMillan, Manager Coal Operations, Northwestern Improvement Co., Seattle, Wash.

The Twin-Deck Suspension Type Coal Washing Table—A new type of installation designed to conserve space in a cleaning plant will be fully covered, explaining the advantages and giving the operating results.

F. S. Ambrose, Construction Engineer, Fairmont Machinery Co., Fairmot, W Va., and

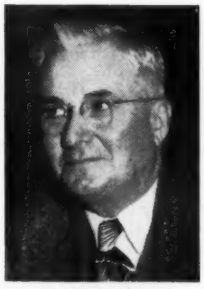
D. H. Davis, Vice-President, Mathies Coal Co., Finleyville, Pa.

10:00 am—Industrial Minerals

(Program to be announced.)

Members—Program Committee

Additional members of the Program Committee will be found on following pages.



I. N. Bayless
Union Pacific Coal Co.

R. K. Beacham
Ayrshire Collieries Corp.

C. R. Boll
Cummins Engine Co., Inc.

A. R. Matthews
Pres., Pocahontas Fuel Co.
National Chairman

A. P. Boxley
Eastern Gas & Fuel Associates

N. T. Camicia
Island Creek Coal Co.

S. A. Caperton
Slab Fork Coal Co.

E. C. Carris
Consulting Engineer
Charleston, W. Va.

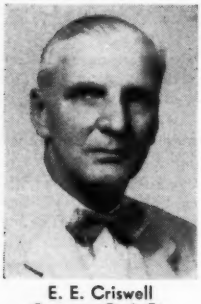
E. R. Cooper
J. & L. Steel Corp.

C. C. Cornelius
Joanne Coal Co.

W. J. Crawford
Enos Coal Mining Co.

Wm. Crawford
Powellton Coal Co.

Program Committee *(Continued)*



E. E. Criswell
Compass Coal Co.

C. M. Donahue
Mine Safety Appliances Co.

W. Stuart Emmons
Hulburt Oil & Grease Co.

Wm. A. Gallagher
Stonega Coke & Coal Co.

Theron G. Gerow
Mining Consultant
Chicago, Ill.

D. N. Griffin
Deister Concentrator Co.

C. M. Guthrie
Peabody Coal Co.

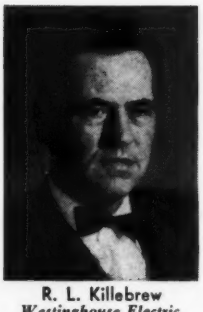
R. G. Heers
Kaiser Steel Corp.

D. K. Heiple
Le-Tourneau-Westinghouse Co.

James Hyslop
Hanna Coal Co.

David Ingle, Jr.
Ingle Coal Co.

W. C. Jones
Jeddo-Highland Coal Co.



R. L. Killebrew
Westinghouse Electric Corp.

A. E. Lamm
Sunnyhill Coal Co.

Arthur S. Macke
Mid-Continent Coal Corp.

H. E. Mauck
Olga Coal Co.

W. L. McMorris, Jr.
U. S. Steel Corp.

L. O. Millard
Link-Belt Co.

M. D. Millard
American Steel & Wire Div., U. S. Steel Corp.

W. D. Moreman
Sanford-Day Iron Works, Inc.

E. M. Pace
Inland Steel Co.

Moss Patterson
West Kentucky Coal Co.

C. B. Peck
Anaconda Wire & Cable Co.

W. B. Petzold
The Hudson Coal Co.

Adrian W. Rich
Fairmont Machinery Co.

H. C. Rose
Pittsburgh Coal Co.

R. H. Seese
Berwind White Coal Mining Co.

S. F. Sherwood
Stonefort Corp.

M. A. Shoffner
Freebrook Corp.

H. H. Smith
National Malleable & Steel Castings Co.

R. B. Warren
Goodyear Tire & Rubber Co.

W. L. Wearly
Joy Mfg. Co.

R. R. Williams, Jr.
Colorado Fuel & Iron Corp.

Robert E. Young
Harnischfeger Corp.

Exhibitors—1957 Coal Show

A

ACF Industries, Inc.
American Car & Foundry Div.
Acme Machinery Co.
Aeroquip Corp.
Allegheny Ludlum Steel Corp.
Allen-Sherman-Hoff Pump Co.
Allied Steel & Tractor Products, Inc.
Allis-Chalmers Mfg. Co.
American Air Filter Co., Inc.
American Brattice Cloth Corp.
American Cable & Hazard Wire Rope Divs.
American Chain & Cable Co., Inc.
American Cyanamid Co.
American Mine Door Co.
American Mine Supply Co.
American Steel & Wire Div.
U. S. Steel Corp.
Anaconda Wire & Cable Co.
Armco Drainage & Metal Products, Inc.
Ashland Oil & Refining Co.
Atlas Powder Co.
Austin Powder Co.

B

Baldwin-Lima-Hamilton Corp.
Construction Equipment Div.
Barber-Greene Co.
Barrett, Haentjens & Co.
Bearing Service Co.
Bemis Bro. Bag Co.
Bethlehem Steel Co.
Bird Machine Co.
Bixby-Zimmer Engineering Co.
Blackhawk Mfg. Co.
Boston Woven Hose & Rubber Co.
Bowdil Co.
Broderick & Bascom Rope Co.
Bucyrus-Erie Co.
Burndy Corp.
Buttner Works Inc.

C

Cardox Corp.
Caterpillar Tractor Co.
Centrifugal & Mechanical Industries, Inc.
Chicago Pneumatic Tool Co.
Cincinnati Mine Machinery Co.
Cities Service Petroleum, Inc.
Clark Equipment Co.
Construction Machinery Div.
Clarkson Mfg. Co.
Cleveland Vibrator Co.
Coal Age
Collyer Insulated Wire Co.
Colorado Fuel & Iron Corp.
Columbus McKinnon Chain Corp.
Combustion Engineering, Inc.
Raymond Div.
Compton, Inc.
Connellsville Mfg. & Mine Supply Co.
Continental Motors Corp.
Cooke-Wilson Electric Supply Co.
Cummins Engine Co., Inc.

D

D-A Lubricant Co., Inc.
Dart Truck Co.
Davey Compressor Co.
Deister Concentrator Co.
Denver Equipment Co.
Detroit Diesel Engine Div.
General Motors Corp.
Diamond Iron Works
Division Goodman Mfg. Co.
Differential Steel Car Co.
Dodge Mfg. Corp.
Dorr-Oliver Incorporated
Dow Chemical Co.
Du Pont de Nemours & Co., Inc., E. I.

E

Electric Steel Foundry Co.
Electric Storage Battery Co.
Exide Industrial Div.
Elliott Service Co.
Elreco Corp.
Ensign Electric & Mfg. Co.
Enterprise Wheel & Car Corp.
Euclid Div., General Motors Corp.

F

Fairmont Machinery Co.
Federal-Mogul Service
Femco, Inc.
Firth Sterling Inc.
Fletcher & Co., J. H.
Flexible Steel Lacing Co.
Flood City Brass & Electric Co.
Fuel Process Co.
Fulton Bag & Cotton Mills

G

Galion Iron Works & Mfg. Co.
General Cable Corp.
General Electric Co., Apparatus Sales Div.
General Splice Corp.
Goodman Mfg. Co.
Goodrich Industrial Products Co., B. F.
Goodyear Tire & Rubber Co.
Gorman-Rupp Co.
Gould-National Batteries, Inc.
Goyne Pump Co.
Gulf Oil Corp.
Gundlach Machine Co., T. J.
Div. of J.M.J. Industries, Inc.

H

Hamilton Rubber Mfg. Corp.
Harnischfeger Corp.
Hendrick Mfg. Co.
Hendrix Mfg. Co.
Hercules Motors Corp.
Hercules Powder Co.
Hewitt-Robins Incorporated
Heyl & Patterson, Inc.
Holmes & Bros., Inc., Robert
Hough Co., Frank G.

I

I-T-E Circuit Breaker Co.
Industrial Physics & Electronics Co.
International Harvester Co.
Interstate Equipment Div.
Yara Engineering Co.
Irwin Foundry & Mine Car Co.

J

Jeffrey Mfg. Co.
Johns-Manville Sales Corp.
Jones & Laughlin Steel Corp.
Joy Mfg. Co.

K

Kaiser Aluminum & Chemical Sales, Inc.
Kanawha Mfg. Co.
Keenan Oil Co.
Kelly Mfg. Co.
Kennametal Inc.
Kensington Steel Co.
Kling Bros. Engineering Works
Koehring Co.

L

Laboratory Equipment Corp.
Lecco Machinery & Engineering Co.
Lee-Norse Co.
Le Roi Division
Westinghouse Air Brake Co.
Leschen Wire Rope Division
H. K. Porter Co., Inc.
LeTourneau-Westinghouse Co.
Lincoln Engineering Co.
Link-Belt Co.
Long Co.
Ludlow-Saylor Wire Cloth Co.
Lukens Steel Co.

M

McLanahan & Stone Corp.
McLaughlin Mfg. Co., Inc.
McNally-Pittsburg Mfg. Corp.
Mack Trucks, Inc.
Macwhyte Co.
Mancha Storage Battery Locomotive
Division Goodman Mfg. Co.
Marion Power Shovel Co.
Martindale Electric Co.
Mechanization, Inc.
Meckum Engineering, Inc.
Metallurgical Products Dept.
General Electric Co.
Mine Safety Appliances Co.
Mining Machine Parts, Inc.
Mining Progress, Inc.
Mining & Quarrying
Ros-Mac Publishing Co., Inc.
Mitchell Industrial Tire Co., Inc.
Moore Co.
Morris Machine Works
Mountain State Equipment Co.
Myers-Whaley Co.

N

National Electric Coil Co.
National Malleable & Steel Castings Co.
National Mine Service Co.
National Supply Co.
National Tube Div., U. S. Steel Corp.
Nolan Co.
Nordberg Mfg. Co.

O

Ohio Brass Co.
Ohio Carbon Co.
Okonite Co.
Olin Mathieson Chemical Corp.
Osmose Wood Preserving Co.
of America, Inc.
Oster Mfg. Co.

P

Page Engineering Co.
Parker Appliance Co.
Pattin Mfg. Co.
Penn Machine Co.
Peterson Filters & Engineering Co.
Pickard Industries, Inc.
Tamping Bag Div.
Pittsburgh Screw & Bolt Corp.
Post-Glover Electric Co.
Productive Equipment Corp.
Proto Tool Co.
Div. of Pendleton Tool Industries, Inc.
Prox Co., Inc., Frank
Pure Oil Co.

Q

Quaker Rubber Div.
H. K. Porter Co., Inc.

R

Radiant Lamp Corp.
Raybestos-Manhattan, Inc.
Manhattan Rubber Div.
Reich Bros. Mfg. Co., Inc.
Reliance Electric & Engineering Co.
Republic Steel Corp.
Reynolds Metals Co.
Roberts & Schaefer Co.
Roebling's Sons Corp., John A.
Rome Cable Corp.
Rust-Oleum Corp.

S

S K F Industries, Inc.
Salem Tool Co.
Sanford-Day Iron Works, Inc.
Schramm, Inc.
Schroeder Brothers Corp.
Shell Oil Co.
Sika Chemical Corp.
Simplex Wire & Cable Co.
Sinclair Refining Co.
Socony Mobil Oil Co., Inc.
Spencer Chemical Co.
Stamler Co., W. R.
Standard Devices Co.
Standard Oil Co. (Indiana)
Standard Oil Co. (Ohio)
Stardrill-Keystone Co.
Stearns Magnetic Products
A Div. of Indiana Steel Products Co.

T

Templeton, Kenly & Co.
Texas Co.
Timken Roller Bearing Co.
Tool Steel Gear & Pinion Co.
Trabon Engineering Corp.
Twin Disc Clutch Co.
Tyler Co., The W. S.

U

Union Wire Rope Corp.
U. S. Rubber Co.
U. S. Steel Corp.
U. S. Steel Supply Div.
U. S. Steel Corp.
Universal Engineering Co.

V

Varel Mfg. Co.
Vascoloy-Ramet Corp.
Victaulic Co. of America

W

Watt Car & Wheel Co.
Weatherhead Co.
Wedge Wire Corp.
Western Machinery Co.
Westinghouse Electric Corp.
West Virginia Armature Co.
West Virginia Works, Connors Steel Div.
H. K. Porter Co., Inc.
White Diesel Engine Div.
White Motor Co.
White Motor Co.
Whitmore Mfg. Co.
Whitney Chain Co.
Wilcox Mfg. Co.
Wilmot Engineering Co.
Winter Weiss Co.
Wire Rope Corporation of America

Y

Youngstown Sheet & Tube Co.

Coal Show

(Continued from page 73)

displays. In addition, a special program of social events has been arranged for them. There will be a Welcoming Luncheon on Monday. On Tuesday, by popular request, another "nautical" party for a sightseeing trip up the Cuyahoga River and along Cleveland's famous lakefront has been arranged. Following a luncheon on Thursday, Jo Portaro, internationally famous hair stylist, will discuss and demonstrate the latest in hair styling.

Advance registration for the 1957 Coal Show has been heavy and Cleveland's hotel accommodations will be taxed to the limit. Some hotels have already been filled to capacity, but the Housing Bureau is attempting to provide comfortable accommodations for all. For those who have not yet asked for reservations, requests should be made promptly to Cleveland Housing Bureau, 511 Terminal Tower, Cleveland, Ohio (Telephone: MAin 1-4110).

Time is growing short. Avoid disappointment by completing your arrangements now to be at the 1957 Coal Show.

Wheels of GOVERNMENT

AMC

As Viewed by HARRY L. MOFFETT of the American Mining Congress

THE tempo of the 85th Congress is much speedier than its predecessors. The major reason appears to be that so many seasoned leaders have returned, organization was completed rapidly, and veteran members head major congressional committees. One senior senator expressed his amazement at the speed when he said it's the first time he can remember that he had to attend 26 committee hearings within the short span of a week.

The legislators have turned their attention to President Eisenhower's Middle East program, extension of existing corporate and excise tax rates, small business assistance, the budget, and a large number of measures which usually have undergone slow progress in previous Congresses.

While the general atmosphere on Capitol Hill is one of a fast pace, several measures requested by the Administration are not making much headway. These include a Presidential request for early enactment of premerger notification legislation, school construction authorization, revision of the Taft-Hartley Act, and approval of U. S. participation in the Organization for Trade Cooperation (OTC).

A few changes have been made in the top echelon of the Administration and others are expected in the months ahead. ODM Director Arthur Flemming has resigned and has been replaced by Gordon Gray, formerly an Assistant Secretary of Defense. Two members of the Civil Service Commission have resigned and one of the new appointees to the Commission is Harris Ellsworth, former Congressman from Oregon and long-time friend of the mining industry.

The Supreme Court is also undergoing personnel changes. Justice Stanley F. Reed, one of the most conservative members on the high bench, has retired from the Court, and the President is expected to name a new Justice shortly.

The Interior Department has whipped into shape a draft of a national minerals policy and has submitted it to the White House for consideration by Presidential advisers. Contents of the proposed program remain a carefully guarded secret. Interior Secretary Seaton has not as yet indicated when such a program will be submitted to Congress, although he has promised that it will be early this year. Several hints from high Administration sources indicate that the minerals policy program may contain some form of tariff aid for domestic producers, as well as tax incentives for the minerals industries.

Purchase Programs in Air

Early in February the House passed and sent to the Senate the first deficiency appropriations bill of the new Congress. In so doing it eliminated $30 million in funds to continue Government purchases of tungsten, fluorspar, asbestos and columbium-tantalum. Prior to the House action, the Appropriations Committee, after hearings, stated that there is clearly no defense justification for further acquisition of these minerals and that continuation of the purchase programs is entirely unwarranted. The Committee was quite critical of the domestic tungsten program approved last year.

During House debate on the measure, no formal effort was made to restore the slash made by the Committee but several members from Western states vehemently protested the removal of the minerals purchase funds.

The Senate Appropriations Committee held hearings on the bill and after careful consideration restored the $30 million requested. A parade of Western Senators and Congerssmen appeared before the Committee urging this restoration.

The measure is now before the Senate where it is believed that approval will be given to the appropriation of the funds needed to continue the program. Most observers are of the opinion that House and Senate conferees will arrive at a compromise amount to be used for continued purchase of these domestic minerals.

Coal Research Hearings

The House Interior Committee has reestablished its special subcommittee on coal research for the purpose of continuing its study for an expanded research program for the coal industry. Members of the subcommittee are the same as in the 84th Congress. Rep. Edmondson (Dem., Okla.) continues as Chairman of the committee. Other members are Reps. Aspinall (Dem., Colo.), Metcalf (Dem., Mont.), Udall (Dem., Ariz.), Saylor (Rep., Pa.), Dawson (Rep., Utah) and Chenoweth (Rep., Colo.).

Field hearings have been held in Ebensburg, Pa., Abingdon, Va., and Wilkes-Barre, Pa., at which representatives of the coal mining industry, mine labor, and the railroads have testified in behalf of an expanded coal research program with basic research to be done by the Federal Government and applied research by the mining and related industries.

At the Ebensburg hearing, J. D. A. Morrow, former Chairman of the Board of the Joy Manufacturing Company, testified in behalf of the AMC Manufacturers Division. He pointed out that the manufacturers of mining equipment had constantly maintained an excellent research program, in collaboration with the coal mining industry, in the development of new mining methods and advanced machinery and equipment. He urged the committee to expand present Federal Government basic research programs in coal and its uses and to leave applied research with respect to mining machinery in the hands of industry. Spokesmen for the coal industry and the miners' union pointed out the work now being done within the industry to broaden

Washington Highlights

CONGRESS: Tempo speedy.
MINERALS PROGRAMS: Funds in question.
COAL RESEARCH: Hearings resumed.
PUBLIC LANDS: Administration studied.
LABOR: Racketeering to be probed.
FREIGHT RATES: Boosted in South.
TAXES: Corporate and excise rates extended.
MINING MACHINERY: Separate code sought.

coal's markets, to increase its use in industry, and urged action to reduce excessive freight rates and to increase the supply of coal-carrying railroad cars.

Chairman Edmondson has announced that the subcommittee plans to draft its reports and recommendations for submission to the House Interior Committee by early April.

Multiple Use Act Studied

Officials of the Bureau of Land Management and the U. S. Forest Service have appeared before the House Mines and Mining Subcommittee of the House Interior Committee and outlined in considerable detail their administration of Public Law 167 of the 84th Congress, which provided for multiple use of the surface resources of public lands while safeguarding the rights of locators of valid mining claims.

The subcommittee directed its main inquiry at administration of the *in rem* procedure set forth in the law. Under that provision, the Government may ascertain surface rights with respect to claims located before the law's enactment, including abandoned, dormant, or unidentifiable mining claims.

Charles P. Mead, an Assistant Director of the BLM, testified that the Bureau's first requirement in implementing Section 5 was the selection of areas where serious conflicts existed between mining claimants and other surface users of the public domain, or where the management of the vegetative and other surface resourecs was hindered by the possible existence of mining claims. There are many areas of the public domain under the Bureau's jurisdiction where the surface values are not sufficient to justify a determination of surface rights, Mead said, or where "there may be but little or no interference or conflict between unpatented mining claims and other uses."

He declared the Bureau's objective "is not to hinder or interfere with mining and mineral development but to promote fuller ultilization of all of the resources of our public lands. The miner is adequately protected [by the law] and will not be disturbed in his legitimate search for, or development of, mineral resources on the public lands. The Bureau recognizes and will continue to recognize that the primary use of land and resources within a valid mining claim should be for legitimate mining purposes."

Mead emphasized that an action under Section 5 does not invalidate or cancel a claimant's right to his claim, but merely determines the extent of his right to surface resources (in addition to those needed in mining operations), prior to patent.

Edward C. Crafts, Assistant Chief of the Forest Service, who outlined his agency's procedure in determining surface rights, said the Forest Service will eventually make such determinations as to 75 percent of the 165 million acres of national forest area in the Western United States and Alaska.

After concurring with Mead's statement that a determination of surface rights under Section 5 does not invalidate or cancel anyone's mineral rights, Crafts gave this summary of Forest Service progress under the *in rem* procedure:

Up to January 1, 1957, 219 areas embracing some 27 million acres with an estimated 227,000 mining claims have been selected for determination of surface rights. Field examination before publication of notice to claimants has been completed on 43 areas covering 3.3 million acres with an estimated 36,700 claims, and the BLM has been requested to publish the required notice. Notice has been published and the subsequent 150-day period for the filing of verified statements asserting rights to the surface has expired as to 7 of the 43 areas, embracing 524,000 acres including some 6200 claims. Mineral examinations have been completed on one of the 7 areas; no hearings on the validity of asserted surface rights have been scheduled.

Up to the same date, Crafts said, 185 verified statements covering 446 claims had been filed for the 7 areas on which the 150-day filing period had expired—or about 7 percent of the estimated total number of claims in those areas. "Our mineral examiners have examined 90 of these claims," he reported, and concluded that 57 of them were of questionable validity. The Forest Service will request hearings to determine the validity of the asserted rights to the surface, he continued, and the decision will be made by the BLM on the basis of evidence presented by the claimant and the Forest Service at a field hearing.

Following the two-day hearings, the staff of the Committee went to California to obtain statements from mining claimholders as to their treatment under the law by Government agencies. Further hearings may be held in Washington at a later date.

Committee aides have indicated that amendments designed to further protect mining claimholders' rights may be drafted and sent the House for consideration.

Labor Racketeering to Be Probed

A full-scale investigation of labor racketeering by a special committee of eight Senators and a preliminary budget of $350,000 for the inquiry have been authorized by the Senate. The probe is expected to get under way shortly.

Members of the special committee, who have until January 31, 1958 to report their findings and specific legislative recommendations to the Senate, are Senators McClellan (Dem., Ark.), Chairman; Kennedy (Dem., Mass.), Ervin (Dem., N. C.), McNamara (Dem., Mich.), Ives (Rep., N. Y.), Vice-Chairman; Goldwater (Rep., Ariz.), McCarthy (Rep., Wis.), and Mundt (Rep., S. D.).

Specifically, the committee is "authorized and directed to conduct an investigation and study of the extent to which criminal or other improper practices or activities are, or have been, engaged in the field of labor-management relations or in groups or organizations of employes or employers to the detriment of the interests of the public, employers or employes, and to determine whether any changes are required in the laws of the United States in order to protect such interests against the occurrence of such practices or activities."

Freight Rates Boosted

The Interstate Commerce Commission has granted Southeastern railroads a 5 percent general increase in freight rates.

The general increase, which the ICC has estimated will produce $61 million annually in additional revenue, includes hold-downs on a number of items, including phosphate rock, potash, lignite, sand and gravel, and salt, as well as several agricultural commodities and lumber, most of which were imposed by the ICC.

The authorized increase also includes a limitation specified by the Southeastern railroads in their request for higher rates. This limits the rate increase on shipments of coal and coke to 10 cents per ton regardless of distance.

The Southeastern lines in mid-November had asked the ICC for an "emergency" across-the-board increase of 7 percent, except for coal and coke. The ICC decided, however, that a 5 percent boost, with exceptions, will satisfy the revenue needs of the Southeastern lines.

House to Act on Tax Bill

Early House approval is expected of a bill (H. R. 4090) to extend for another year corporate and excise taxes as requested by President Eisenhower. The bill was approved early in February by the House Ways and Means Committee after brief hearings. The corporate income tax is now 52 percent, which includes a 30 percent normal tax and a 22 percent surtax on incomes over $25,000. The rate was due to drop to 47 percent on April 1 with the 22 percent surtax remaining the same and the normal tax rate dropping to 25 percent.

The reported bill also continues existing excise tax rates on cigarettes, beer, distilled spirits, and automobiles.

Treasury Secretary George Humphrey, in opposing any tax cuts, had

(Continued on page 89)

Bethlehem Roof Bolts, used with square plates and wire mesh, in metal mine.

You get increased safety with Roof Bolting

Mines become safer, with the danger of severe roof falls unlikely, when you install Bethlehem headed roof bolts. This is because the bolts anchor overlying strata into a thick, secure beam.

Bethlehem roof bolts have other advantages, too. Their use makes possible wider openings and clearances . . . full use of mechanized equipment at the face . . . good ventilation, due to the absence of bulky supports . . . and no fire hazard.

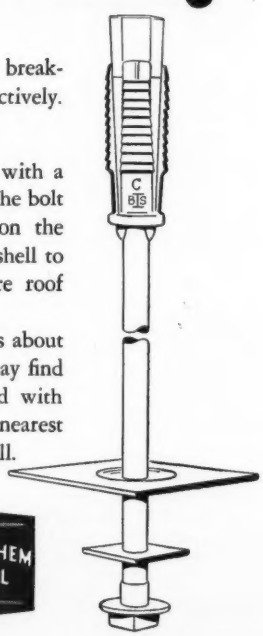
Four Types of Headed Bolt

The Bethlehem square-head roof bolt is manufactured in four types: a ¾-in. carbon-steel bolt and a ⅝-in. high-strength bolt, each of which has a typical breaking load of 24,000 lb; a ¾-in. and a ⅞-in. high-strength bolt, having typical breaking loads of 34,000 lb and 45,000 lb, respectively.

How Bolt Is Used

The Bethlehem headed roof bolt is used with a malleable-iron shell and steel plug. When the bolt is tightened, the plug is drawn down on the threads, expanding the four leaves of the shell to provide positive locking action. A square roof plate provides additional support.

We'll be glad to answer your questions about using the square-head roof bolt. Or you may find our 1-in. slotted roof bolt, which is used with a steel wedge, more to your liking. The nearest Bethlehem sales office is awaiting your call.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

AMC Personals

The Anaconda Co. has announced several personnel changes at the Anaconda Reduction Department, Anaconda, Mont.

W. A. Emanuel has been named manager, succeeding **W. E. Mitchell** who retired January 1 after 45 years of service. **Frank Day**, assistant general superintendent of pyrometallurgy, has been promoted to general superintendent of the department.

F. H. Day

W. A. Emanuel

John Moore, assistant general superintendent of hydrometallurgy, is now assistant general superintendent, and **John Booles**, assistant superintendent of concentration, has been advanced to concentrator metallurgist.

Clifford F. Milkwick, formerly superintendent of the concentrator has been named superintendent of employe relations while **Fred A. Roeder**, former assistant concentrator superintendent, has been promoted to superintendent.

At the Butte, Mont., headquarters, **Karl Lundborg**, assistant chief engineer was named to succeed **Rollin J. Kennard**, chief engineer (mechanical and electrical) of Anaconda's western operations.

The appointment of **Lee Messerly** as general superintendent in charge of mining operations for Federal Uranium Corp. has been announced. Messerly recently resigned as mine superintendent for Hecla Mining Co. He first joined Hecla in 1923 and had served continuously with the company since 1930.

William T. Pettijohn has been appointed assistant to the vice-president in charge of mining and exploration, The New Jersey Zinc Co. Pettijohn started his employment with New Jersey Zinc in 1948 at Austinville, Va. He served as superintendent of the Hanover, N. M., mine from 1952 to 1954 when he was transferred to New York to become assistant to the manager of exploration.

J. R. LeGrand has been appointed assistant production manager of the Consolidated Feldspar Department of the Industrial Minerals Division, International Minerals and Chemical Corp.

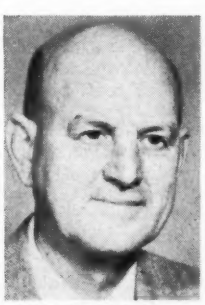
He has been superintendent of the company's mica plant at Erwin, Tenn., for the past year.

Following 41 years of service devoted to greater safety for coal miners and pioneering in the application of electricity to the mining industry, **Ernest J. Gleim** has retired as chief of the electrical-mechanical testing branch of the U. S. Bureau of Mines Health and Safety Division. Gleim joined the Bureau four years after its organization. He has long been active in the work of the Power Committee of the American Mining Congress Coal Division and has played a most important part in the development of electrical equipment to be used in gassy or dusty atmospheres.

Robert S. James replaces Gleim as chief of the electrical-mechanical testing group.

Walter Gillingham has joined the staff of the National Lead Company's mine at Baxter Springs, Kans.

Frank P. Knight, mining engineer of Tucson, Ariz., has been appointed acting director of the Arizona Department of Mineral Resources. He takes over the position vacated by the untimely death of **R. C. Manning**, department director since 1951.



F. P. Knight

Knight has been active in Arizona mining operations since 1937 when he took over the management of the Christmas Copper Corp. In 1939 he was made vice-president of the company, and has served as president since 1953.

Alvin J. Thuli, Jr., has been appointed chief engineer of the Utah Copper Division of Kennecott Copper Corp.

He succeeds **L. C. Jones** who retired November 30, after 48 years of service. Thuli was formerly assistant chief engineer, a position he held since 1956.

Adolph Q. Lundquist was recently appointed a vice-president of Union Carbide Nuclear Co., a division of Union Carbide and Carbon Corp. Lundquist joined Union Carbide in 1942 as assistant superintendent of Uravan, Colo., operations of United States Vanadium Corp., the Division of Union Carbide that was succeeded by Union Carbide Nuclear. In 1945 he was transferred to Rifle, Colo., as superintendent of the company's plant there and in 1952 was appointed general superintendent of all mills in Colorado. He was made general manager of Colorado Plateau operations in 1955.

Roland C. Luther was elected vice-president of Pocahontas Fuel Co., Inc., January 26. He continues as president of Peerless Coal and Coke Co., which was acquired as a wholly-owned subsidiary by Pocahontas Fuel last September.

Emmett G. Solomon was appointed a director, and vice-president and treasurer of The Bunker Hill Co., January 30, replacing the recently deceased Daniel J. Murphy. Solomon will also be a member of the Executive Committee.

Escar R. Wren is the new president and treasurer of Standard Sulphur Co., which is mining sulphur at Damon Mound, Tex. He succeeds **Gilbert B. Ebarb, Sr.**, who resigned.

The M. A. Hanna Co. has announced the appointment of **W. F. Shinners** as manager of Michigan District mines. He replaces **S. E. Quale** who retired after serving 39 years with the company.

Kurt R. Kuehlthau was appointed general superintendent of underground mines and **J. D. McAuliffe** was named superintendent of the Homer-Wauseca mines.

Jack H. Morrow, who has been chief mining engineer, is now operating engineer of the Homer-Wauseca mines. **Richard W. Peterson**, who had been in the engineering department, was appointed chief mining engineer of Michigan District.

Ralph H. Knode, board chairman of Stonega Coke & Coal Co., has announced the election of **E. B. Leisenring, Jr.**, as vice-president of Stonega Coke & Coal Co.; The Virginia Coal & Iron Co.; Westmoreland, Inc., and Westmoreland Coal Co. Leisenring had previously been assistant to E. H. Humphrey, president of Stonega.

John G. Strohl has been appointed general manager of the Camp Bird Mine at Ouray, Colo. **C. P. Tremlett**, chief geologist of Camp Bird Limited, has been acting manager at the Camp Bird Mine since the end of last October.

The Mining Association of Montana elected as its president, **John Bley**, vice-president and general manager of the American Chrome Co. at Nye, Mont., at a meeting held in mid-January.

Following 38 years of service with the California Portland Cement Co., **L. E. Bancroft** has resigned as executive vice-president. **Richard A. Grant**, vice-president and assistant to the president, has been elected to succeed Bancroft.

Vincent D. Perry, chief geologist for the Anaconda Co. since 1948, was elected a vice-president of the company in late January. Perry joined Anaconda in 1924 as mining geologist and has held geological management posts for the company and its subsidiaries throughout the western hemisphere in subsequent years.

Several staff promotions in the Mining and Smelting Division of The Eagle-Picher Co. have been announced.

Claude O. Dale is now assistant general manager and will work out of the Division's main office at Miami, Okla.

Robert L. Haffner was made manager of the company's Illinois-Wisconsin operations, succeeding Dale. **Harold H. Haman** takes over as general superintendent of the Illinois-Wisconsin operations with **Henry B. Farrey**, formerly chief engineer, succeeding Haman as superintendent of the company's Linden, Wis., mine.

In the Tri-State District, **F. J. Cuddeback** was appointed general manager to succeed **H. W. Harrison**, retired. **J. B. Elizondo** succeeds Cuddeback as general superintendent of Tri-State Mines and **Lloyd Wetherell** is promoted to assistant general superintendent.

Howard Steidle, formerly assistant to the president, Reading Anthracite Co., has joined the Lukens Steel Co. at Coatesville, Pa., as manager of the Business Diversification Department.

New officers of the Silver Shield Mining & Milling Co. include: **Edward L. Kmeck**, president, and **Zane Morrison**, vice-president.

— *Obituaries* —

Joseph F. Joy, 73, founder of the Joy Manufacturing Co., died February 19. Mr. Joy's name was synonymous with mechanized mining equipment. He invented the first coal loading machine which he patented in 1916. Other major inventions included conveyors, blasting devices, locomotives, drills, stopers, cutters, tractor mechanisms, pumps, hydraulic jacks, hoisting mechanisms, tunneling machines, and loaders.

He organized the Joy Machine Co. in 1919 to manufacture and sell his Joy loader, placing it on the market in 1922. He sold his interest in the company in 1925 which was then incorporated into the Joy Manufacturing Co. Later he founded the Joy Brothers Co. of Marion, Ohio, which he sold to the Sullivan Machinery Co.

In 1938, he established himself as a consultant and invented and introduced the Joy Safety Drill.

During World War II he served the Federal Government as senior ordnance engineer in the office of the chief of ordnance, U. S. Army. After the war he became a consultant for the Joy Manufacturing Co., a position he held until his death.

J. Gordon Hardy, 83, founder and former president of Falconbridge Nickel Mines, died at his home in Reading, Conn., December 14. Mr. Hardy, who founded Falconbridge in 1928, retired in 1945 but continued as a consultant for several years.

Bernard P. Manley, 75, colorful figure in the coal mining industry of the west for half a century, died January 8. He had been executive secretary of the Utah Coal Operators Association since 1932.

Mr. Manley was born in England and came to this country when he was 17. After a short period as a Mississippi River boatman and a cowboy he became a coal miner in Oklahoma. In the next 31 years he operated mines in Oklahoma, Colorado, Wyoming, and Utah. He joined the Utah Coal Operators Association in 1932.

George Dunglinson, Jr., 74, retired Norfolk and Western Railway official, considered one of nation's leading coal experts, died January 21 in Roanoke, Va. At the time of his retirement in 1955, he was executive vice-president of the N & W.

Mr. Dunglinson worked as a mining engineer in West Virginia before joining the N & W as a member of the car allotment commission in 1908. He was named chairman in 1912. In 1936 he went to Roanoke as assistant vice-president in charge of traffic.

John V. Berry, veteran safety director of Bethlehem Mines Corp., died January 6 at his home in Johnstown, Pa. Following 10 years with the U. S. Bureau of Mines rescue committee for coal and metal mines, Berry joined Bethlehem Mines in 1923.

James W. Morgan, 57, president of Ayrshire Collieries Corp. and subsidiaries, of Indianapolis, Ind., and a vice-president of National Coal Association, died February 1.

His career dates back to 1921 when he went to work for Lilly (Pa.) Coal Co., occupying successively the positions of clerk, foreman and superintendent. Moving to A. A. Hughes & Co., Cressona, Pa., as assistant general manager in 1924, he eventually became vice-president and treasurer. He was assistant to the vice-president of Truax-Traer Coal Co., Chicago, from 1948 to 1949.

Mr. Morgan was appointed vice-president and general manager of Ayrshire Collieries Corp. in 1949, and since 1950 has been president and director. He was also a director of Frontenac Coal Corp. and Republic Coal & Coke Co., and was assistant deputy coal mines administrator of the Department of Interior, 1943-44.

Active in the American Mining Congress and a recognized leader in the industry, he will be deeply missed.

Marions Mine Iron Ore in the Wilds of Canada

Deep in a wilderness along the border between Labrador and Quebec, several Marion 4161 electric shovels load out high-grade iron ore to help feed steel furnaces all over the world. These 6-yard machines operate 12 months of the year—giving high output with minimum downtime in temperatures that fluctuate from summer's average 65° above zero to winter's average 20° below.

Heavy-duty construction of this ¾-yard Marion 35-M shovel matches the ruggedness of larger machines in the Marion line. For loading out coal—for any tough job—you need a durable machine. And there's a Marion to meet your need.

CONSULT MARION MINING SPECIALISTS
for lowest costs on your property!

MARION POWER SHOVEL COMPANY—MARION, OHIO, U. S. A.

Fight Coal Mine Fire

A concentrated effort, aimed at stamping out a ten-year-old mine fire is under way in Carbondale, Pa. Federal and State Governments as well as the city expect to spend more than $2,000,000 in a massive excavation job in the 120 acres affected by the underground anthracite blaze.

According to plans, the fire will be attacked from three directions at once. The average "cuts"—the area will be strip-mined—will reach a depth of 90 ft and a width of 270 ft.

A portion of the cost of the project will be paid off by an estimated $425,000 in royalties on coal unearthed in the course of the work.

More Canadian Iron Ore

The United States Steel Corp. subsidiary, Cartier Mining Co., Ltd., is reportedly planning the formation of a new Quebec company to investigate and develop a large ore mining site north of Shelter Bay, Quebec, Canada. The project will involve a large expenditure if proven to be worth while.

Iron ore concentrating plants would be built to produce high-grade concentrates, suitable for blast furnace use, from the low-grade deposits with an iron ore content of about 30 percent. A ship-loading center would be established at Shelter Bay, a village on the St. Lawrence River.

The project would also call for a 150-mile railway to the first mining site, 70 miles south of Mount Wright, a mining town, and a hydroelectric power plant on the Hart Jaune River.

The new Canadian company would be known as Quebec Cartier Mining Co.

Attack on Water Pollution

Dr. S. A. Braley of Mellon Institute of Industrial Research is confident he has found a way to prevent future coal mines from polluting streams. The idea does not apply to old abandoned mines.

Dr. Braley's new idea is to prevent the water from ever becoming contaminated.

He reasons that the water is pure before the mine is opened. There is no chemical reaction until air comes in contact with the underground elements. If the water is removed quickly, it will not be polluted.

The preventive idea is the basis for a mine drainage and pumping system being installed at the Humphrey Mine which Pittsburgh Consolidation Coal Co. plans to open this summer at Cresaps, W. Va.

BERTHA C. WILKERSON, after 35 years of service to the American Mining Congress, has retired as production manager of MINING CONGRESS JOURNAL and will devote full time to her many outside interests.

To the people who produce MINING CONGRESS JOURNAL, Bertha is the JOURNAL. She learned magazine production as the JOURNAL developed and is in a great way responsible for the high ranking that it enjoys today.

In addition, she filled many important posts in connection with A. M. C. Conventions and Expositions and is well known for her work with convention exhibitors.

Her genial personality and calm disposition —in spite of the rush of pressure inherent in meeting monthly publication deadlines—have endeared Bertha to her colleagues on the Mining Congress staff as well as to thousands who worked closely with her as advertisers, authors, printers and engravers. Her proficiency extended far beyond a complete knowledge of editorial techniques, and she inspired a spirit of cooperation in all those who have worked with her.

Manganese Corporation Formed

Formation of a new company, U. S. Manganese Corp., to produce manganese from domestic ores, and the award of a contract from the General Service Administration to pilot a process for such production have been announced by Vitro Corp. of America. The new company is owned 40 percent by Vitro, 40 percent by Sheer-Korman Associates, Inc., and 20 percent by Great Divide Mining & Milling Corp.

The GSA contract, extending 19 months and totaling $270,541, was awarded to Vitro Laboratories Division, which will equip, operate and maintain the pilot plant in its West Orange, N. J., Laboratory to develop the economic factors for full-scale production by the Sheer-Korman high intensity arc process of metallurgical grade manganese from rhodonite.

Meeting Announced

The spring meeting of the Central Appalachian Section (AIME) will be May 24 and 25 at Maple Shade Inn, Pulaski, Va. May 24 will be devoted to technical papers with the morning session a joint meeting between the fuels and non-fuels interests. In the afternoon, these two groups will have separate technical sessions. Saturday will be devoted to a field trip through the Austinville mine and concentrating plant of The New Jersey Zinc Co.

Snyder Leases The Godfrey

Oliver Iron Mining Division of U. S. Steel Corp. has assigned a lease on the Godfrey underground mine near Chisholm, Minn., to the Snyder Mining Co.

Snyder Mining Co., owned by The Shenango Furnace Co. and Crucible Steel Co., will operate the Godfrey in conjunction with its adjacent South Tener Mine, using the hoists and surface facilities of the Godfrey for both properties.

Owned by the W. R. Burt estate in Saginaw, Mich., the Godfrey shipped its first ore in 1927. It produced 11,500,000 tons before it was shut down in March 1955.

Canada's Mineral Output

Canada's mineral production in 1956 topped all previous records by a wide margin, passing the $2 billion mark for the first time, according to the Dominion Bureau of Statistics.

Value for the year was put at $2,067,699,000, exceeding 1955's total by $272,388,000 or 15 percent — nearly double the 1950 value of $1,045,450,000.

The value of all metallics climbed to $1,134,354,000 from 1955's $1,007,840,000.

African Mine Cuts Output

Crown Mines, the largest individual mining property in the Johannesburg, South Africa, goldfield, has curtailed operations after 59 years. The board of diretcors announced that a 25 percent cut in operations was ordered because of recent narrow profit margins and the progressive exhaustion of gold reserves in parts of the mine. About 450 of the 2000 white workers and a number of the 19,000 African miners will be laid off.

Since crushing operations started in 1897, 140,000,000 tons of rock have been crushed, producing more than 37,000,000 oz of gold.

Coal Extension Course

The Mining and Industrial Extension Department of the School of Mines at West Virginia University will operate a series of short courses during the summer of 1957 to provide technical and specialized industrial instruction for employes of the coal mining and other industries in the State. This year's program represents the continuation of policies and practices which have been continuous for the past 44 years, beginning with the first annual short course in coal mining in 1913.

The seventh annual short course in coal preparation will be offered at Morgantown beginning June 10, and continuing through July 19. This course is designed to benefit persons engaged in the operation of modern coal preparation and cleaning plants and includes both the theory and practice of sampling, crushing, sizing, cleaning and drying of coal, the operation of typical coal cleaning equipment, materials handling, plant efficiencies and quality control.

The forty-fifth annual short course in coal mining will be held at Morgantown and at Logan, W. Wa., for an eight-week period beginning July 8, and extending through August 30. A new plan of operation is designed to permit employed persons to attend the short course with minimum interference with their normal work schedules.

Subjects covered will include mining methods, mine gases, mine ventilation, materials handling, explosives and blasting, mine drainage, timbering and roof control, instruments and apparatus and principles of supervision.

Titanium Production Begun

Electro Metallurgical Company's titanium sponge plant at Ashtabula, Ohio, the nation's largest with a rated annual capacity of 7500 tons of titanium sponge, has been producing on a capacity basis since December. The plant is the first in the United States to produce titanium metal sponge commercially by the sodium-reduction process rather than by the magnesium-reduction method.

Capacity production was attained less than nine months after the first batch of titanium sponge was produced at Electromet's plant, April 26, 1956.

New Sulphur Plant

Texas Gulf Sulphur Co. has begun the construction of a multimillion-dollar plant for mining sulphur at the Fannett Dome in Jefferson County, Tex., near Beaumont. Design work on the plant has been completed and all major equipment ordered.

Niagara Falls Plant Expansion

The Niagara Falls plant of National Lead Company's Titanium Alloy Manufacturing Division is undergoing a major expansion of its manufacturing facilities which is scheduled for completion by July 1.

A new building for the expanded production will house equipment consisting of mills, pulverizers, mixers, dryers and tanks with necessary handling equipment.

Expansion is necessary to satisfy increased demand for zirconium oxide and zirconium silicates.

Wheels of Government

(Continued from page 81)

said earlier that "after two years of balanced budgets as a result of the combined hard work of the Congress and the Administration, it would be inexcusable to slip back into deficit financing for next year."

New Census Code Sought

The American Mining Congress has called upon the Bureau of the Budget to establish a new Census Bureau four-digit industry code for mining machinery to be carried in future Census reports.

The AMC said that both the mining and mining equipment manufacturing industries have long recognized the need for such a code. It was pointed out that mining equipment manufacturers now have to report under the same code as manufacturers of construction machinery and that this precludes the resulting statistics from having any real value for either industry. The Mining Congress emphasized that the mining equipment manufacturing industry meets all Government criteria for being classified as a separate industry. It pointed out that the dollar value of shipments of mining machinery exceed those for the oil field and tool industry for which there is now a separate industry code.

The Mining Congress also told the Budget Bureau that while there are "fringe" products common to both the mining machinery and construction machinery industries, the allocation of these products between the two industries is not too difficult.

National defense requirements dictate the need for a separate Census classification for mining machinery, the AMC told the Budget Bureau. It said that "in times of emergency, the Mining Machinery Industry is responsible for supplying promptly the machines, equipment and accessories needed by the copper, aluminum, iron ore, coal, lead, zinc, uranium and all other types of mines which must maintain and expand their production of the basic raw materials so urgently needed for military equipment." The AMC further declared that for this reason "accurate data as to the strength and scope of the Mining Machinery Industry is of the highest importance to the Government, the mining industry and the manufacturers of mining equipment, both in planning for the future and in meeting the needs in time of war."

Further support for the AMC request may come from members of the Special Coal Research Committee of the House Interior Committee. A copy of the Mining Congress letter to the Budget Bureau was incorporated in the Committee's hearings on coal research and some committee members indicated that they would seek its approval by the Bureau.

Pilot Plant Agreement

The International Nickel Co. of Canada, Ltd., has concluded an agreement with the Texas Gulf Sulphur Co. for the operation of a pilot plant at Copper Cliff, Ontario, Canada, to investigate processes for the recovery of elemental sulphur from sulphur-dioxide-bearing gases.

The pilot plant will be built near the site of Inco's new iron-ore recovery plant. It will consist of two sections, one for scrubbing and cleaning gas and one for reduction of the sulphur dioxide to elemental sulphur.

The fluid bed roasting process used in the Inco plant, the first $19,000,000 unit of which went into operation in January 1956, yields sulphur dioxide gas suitable for the production of useful by-products. This development, plus recent improvements in the technology of sulphur dioxide reduction to elemental sulphur, has resulted in the decision by Inco and Texas Gulf to advance experiments to the pilot-plant level.

Cherry Hill Buys Gay

Cherry Hill Coal Corp., Cleveland, has purchased the Gay Coal & Coke Co. of Mount Gay, Logan County, W. Va. with assets valued at $1,250,000. Average production of the Gay mines is 35,000 tons per month. In 1956, nearly 400,000 tons of coal were shipped by this company.

The Gay Company was founded in 1904; coal reserves on owned or leased acreage are estimated to be in excess of 10,000,000 tons.

In addition to this newly-acquired property, Cherry Hill owns and operates the Lucille Tipple at Hoard, W. Va., and the George's Creek Coal & Land Co., Lonaconing, Md.

Smelter Construction Center

International Nickel Co. of Canada, Ltd., has commenced preliminary construction on a new $12,500,000 concentrating plant at Copper Cliff, Ontario. Located on a site adjacent to the company's Levack Mine, the mill will have a rated capacity of 6000 tons per day. Unlike the Creighton mill, which produces a bulk concentrate pumped to the Copper Cliff reduction plant by pipe line, the Levack Mill will produce both nickel sulphide and copper sulphide concentrates.

The nickel concentrate will be treated at Inco's Coniston smelter, replacing part of the present feed to that plant, and the copper concentrate will be treated at Copper Cliff.

Alcoa Leases Terminal Area

A second step toward completion of a million-dollar Aluminum Co. of America ore terminal on Lydia Ann Channel near Aransas Pass, Tex., has been announced by Aransas County Navigation District No. 1.

The district agreed to lease the company 103 acres of submerged land in the channel and 284 acres of Harbor Island, as well as to grant the company a 20-year franchise for dredging and constructing channels and other facilities for transferring bauxite from ocean-going vessels to Intercoastal Canal barges.

Titanium Production Tripled

Production of the 6-year-old domestic titanium industry nearly tripled in 1956, according to Titanium Metals Corp. of America.

Production of finished mill shapes totaled 10,600,000 lb, compared with industry expectations of about 8,000,000 lb and 1955's 3,800,000 lb. About 23,000,000 lb of mill products are scheduled for 1957 delivery.

— BOOK REVIEWS —

THE COAL INDUSTRY IN EUROPE. *A study by the Coal Committee of the Organization of the European Economic Cooperation. Available at OEEC Publication Office, 2000 P St., N. W., Washington 6, D. C.*

IN December 1954 the Coal Committee drew up a report entitled "The Coal Industry in Europe," which discussed the trend in the coal industry in 1954 and the short term prospects for 1955 as far as Europe is concerned. The present report contains revised figures for 1954 and considers the factors which have influenced developments in Europe's coal industry since. It also includes a number of considerations on which estimates can be based concerning the future trend of the coal market.

This is a valuable booklet for those who are concerned with the European market for domestically produced coal.

MINERALS OF CALIFORNIA — BULLETIN 173. *State of California, Department of Natural Resources, Division of Mines, Ferry Building, San Francisco 11, Calif. $3.00.*

MINERALS of California has been prepared by Dr. Joseph Murdoch of the University of California, Los Angeles, and Dr. Robert W. Webb of the University of California, Santa Barbara College, as part of a continuing cooperative project between the Division of Mines and the State University.

The bulletin is essentially a catalog of mineral species and is a basic reference for all persons interested in minerals. Minerals are arranged in alphabetical order so that only the name of the mineral need be known to find it. Occurrences are listed by counties for each mineral, and when of particular importance or interest, are accompanied by a brief description of their geologic setting.

The bibliography, containing some 2000 titles, does not attempt to cover all notices of California minerals, but it reportedly is the most comprehensive yet assembled on California mineral occurrences.

ELEMENTARY CRYSTALLOGRAPHY. *M. J. Buerger, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $8.75.*

AN introduction to the fundamental geometrical features of crystals, the book provides a penetrating study of the symmetry properties of crystals, which are basic to all other phases of crystallography.

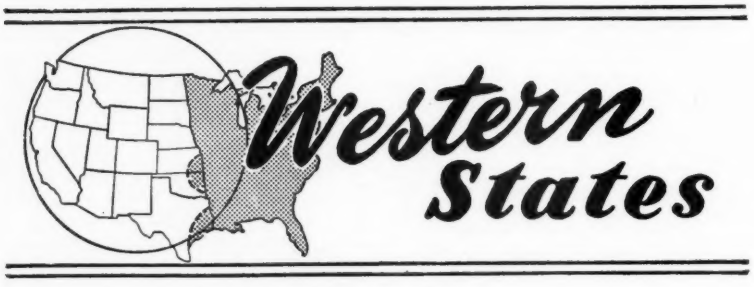
The subject matter of this volume falls into three sections. About the first half of the book is devoted to a rational development of the megascopically observable symmetries of crystals. A second part of the book is devoted to a discussion of the internal symmetries of crystals. The third section contains some advanced material. As a kind of appendix on advanced methods, the book ends with three chapters which are concerned with group theory and its application to symmetry.

CLASSIFICATION OF ROCKS. *Department of Publications, Colorado School of Mines, Golden, Colo.*

The Colorado School of Mines Quarterly, "Classification of Rocks", is now available in a revised edition. Written by Dr. Russell B. Travis when he was assistant professor of geology at Mines, it is designed to prevent confusion that results from the many varied methods of rock nomenclature. Dr. Travis has named rocks on the basis of visible features, using terms and conventions generally accepted at present. Included in the illustrated Quarterly are full instructions for naming any rocks—igneous, sedimentary, or metamorphic—and three complete reference charts for use in the field or classrooms. Cost is $1.00 postpaid in the United States.

COAL MINING. *I.C.F. Statham, Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. $15.00*

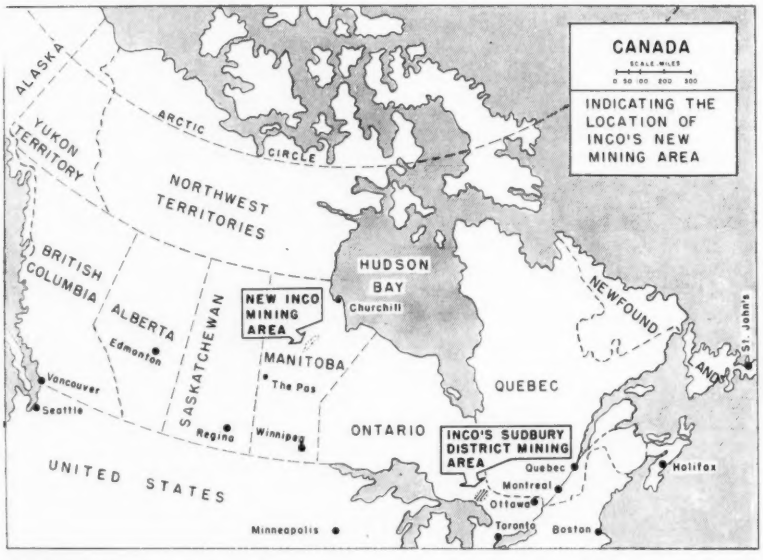
In this book the author has endeavored to give an unbiased picture of the past and present of the coal mining industry of Britain, of its vital importance to the nation and of some of the many directions in which progress is being made in the battle for coal. Some of the many subjects treated are: The origin and occurrence of coal; the planning of a colliery; surface plants; organization, administration and personnel of the mining industry; underground mining machinery and techniques; and safety, welfare and training. All persons connected with the coal mining industry will find this text an interesting, if not valuable, addition to their bookshelf.



Inco Enters Manitoba

Plans for the development over the next three to four years of a $175,000,000 nickel project in the Mystery-Moak Lakes area in Northern Manitoba were recently announced.

The new Inco mine sites are located about 400 air miles north of Winnipeg and 950 miles northwest of the company's operations in the Sudbury District. They are in an area from 30 to 50 miles north of Thicket Portage which is on the Canadian National Railways' line between Winnipeg and Churchill on Hudson Bay. A power plant will be located about 50 miles northeast of the mining operations and approximately 10 miles northwest from the present C.N.R. Hudson Bay line. Moak Mine and the Thompson Mine and townsite will be linked together by a 20-mile company-operated railway and a new 30-mile C.N.R. spur line will connect the Thompson townsite with the C.N.R. Hudson Bay line from a point north of Thicket Portage.



International Nickel will open two new nickel mines in the area, to be known as the Thompson and the Moak Mines. The project will constitute the biggest nickel-producing operation in the world next to Inco's operations in the Sudbury District of Ontario and will be the largest single investment of any kind in Manitoba. By arrangement with the Manitoba Government, the new town and the plant site, as well as the immediately adjacent mine, are to be named Thompson in honor of Dr. John F. Thompson, chairman of the board of Inco, who in 1953 completed 50 years of service with the company.

With initial production scheduled for 1960, the project in Manitoba together with the progress under way at Sudbury will lift Inco's regular 1955 annual nickel-producing capacity by approximately 130,000,000 lbs to 385,000,000 lbs, or by 50 percent, of which some 24,000,000 lbs will be regular production to replace existing temporary premium-priced production for the United States national stockpile.

The territory over which favorable mineralization has been found is some 75 to 80 miles in length, with the width averaging approximately five miles. Further extensive exploration work will be necessary within the limits of the area outlined. The company's objective is to develop tonnage and grade potentials sufficient to maintain large nickel production and the longest possible future life of this area in the same way that these have been possible at Sudbury.

Ammonium Phosphate Fertilizer

E. S. McGlone, executive vice-president, The Anaconda Co., has announced that his company will purchase anhydrous ammonia from U. S. Steel Corp., Geneva, Utah, to be used in the production of ammonium phosphate fertilizers at Anaconda's Montana facilities. U. S. Steel is building an $18,000,000 chemical plant at Geneva, which will have an annual capacity of 70,000 tons of anhydrous ammonia, and Anaconda will spend $1,000,000 on expansion of its Montana plant.

Idaho Mineral Production Up

Increased production of copper, cobalt, mercury, phosphate, sand and gravel helped boost the value of Idaho's 1956 mineral production by an estimated seven percent over 1955. This was noted by the Albany, Ore., regional office of the United States Bureau of Mines.

The estimated production was valued at nearly $73,000,000, compared with the 1951 record of nearly $83,000,000.

Zinc output declined nearly 15 percent to its lowest level since 1939, the report said. Tungsten, silver, lead and gold production were also down.

Bunker Hill to Develop Old Mine

Deep exploration and development of the old Senator Stewart mine in Deadwood Gulch, near Kellogg, Idaho, one of the district's big early-day silver-lead producers, will be a 1957 project of The Bunker Hill Co.

The firm has concluded a perpetual working agreement with Silver Bowl, Inc., owner of the property, to undertake the exploration program on a profit-sharing basis, according to an announcement by Silver Bowl officials. Bunker Hill will finance the work and will be reimbursed for its development expenditures before any division of profits, they said.

Plans for the project are being drawn up and preliminary underground preparations will get under way as soon as it has been decided which of the Bunker Hill's lower levels will provide the most advantageous access to the area involved in the contract, a Bunker Hill official reported. Some 1500 ft of tunnel will be necessary to reach the southern boundary of the area, he noted.

Lime Plant Nears Completion

Chemical Lime Co., Portland, Ore., is nearing completion of its $1,250,000 chemical lime plant near Baker, Ore. Designed to produce 75,000 tons annually, the plant will draw upon a deposit indicated to contain some 30,000,000 tons of high grade limestone. This product will be utilized in the manufacturing of carbide, sugar, glass steel, aluminum, paper products and used in agricultural processes.

Safer During 1956

The 6600 employes of Kennecott's Utah Mines Division were three times safer on the job during 1956 than the average employe in similar operations.

During the year, Kennecott workers at the Bingham Canyon open-pit copper mine, the two mills and refinery turned in a total of 14,000,000 man hours of work with only 53 disabling injuries.

Using the American Standards Association's formula, this results in an accident frequency rate of 3.80 accidents per million man hours worked at Utah Copper Division. The national average for similar operations is 12.59 accidents per million man hours worked, and for all industry the national average was reported to be 6.9 accidents per million man hours of work.

In reporting the low accident rate, L. F. Fett, general manager of the Utah Copper Division, said the outstanding cooperation of individual employes and supervisory personnel in regard to safety practices was mainly responsible.

Pett reported a steady decrease in the number of accidents per man hours of work since 1952, with an over-all 54 percent improvement over ten years ago.

Idaho Mine Meet Set

The Idaho Mining Association will hold its 54th annual convention in Sun Valley July 15 and 16, according to Harry W. Marsh, secretary. The meeting will be educational in purpose, he said, and will emphasize Idaho's mineral potential.

Buys Wyoming Mine

Continental Uranium, Inc., has purchased the Crooks Gap Mine in Fremont County, Wyo., from the Gaddis Mining Co., for an estimated $3,250,000. Announcement of the purchase was made by Gerald Gidwitz, chairman of Continental, who said the exact price would be determined following verification of the uranium ore potential of the mine. Continental will begin its evaluation of the property at once. "If the Gaddis estimates are confirmed," Gidwitz stated, "the total price will be approximately $3,250,000, payable partly in cash and partly in Continental common stock."

Colorado Mineral Output Tops

In its annual preliminary report, the U. S. Bureau of Mines set a figure of $306,270,000 for Colorado's 1956 mineral production—which includes a wide variety of minerals and oil and natural gases, but not uranium. This represented a gain of seven percent over 1955.

The figures on uranium, still restricted by the Atomic Energy Commission, would add at least another $100,000,000 to the total, competent mining men have estimated.

Although total production of the metallic minerals decreased six percent in 1956, value was up four percent. Value gains were made by copper, gold, lead, vanadium and zinc, but silver and tungsten slipped. Value of the 1956 molybdenum production is unreported, but production dropped from 43,043,000 lb in 1955 to 37,500,000 in content of ore and concentrates.

Value of non-metallic minerals showed a gain of eight percent, with increases in feldspar, cement, gypsum, stone, clay, salt, sand and gravel. However, fluorspar, pumice, and cumicite production declined.

Petroleum and natural gas values registered gains.

Potash Operation Started

Production at the new National Potash Co. installation near Carlsbad, N. M., is now under way. The $18,000,000 project was begun in May 1955. McKenzie & Whittle, Contractors, Dallas, Tex., sunk two shafts approximately 1700 ft deep, and Stearns-Roger Mfg. Co., Denver, contracted the surface work.

About 300 persons will be employed when the mine and refinery are in full production. Three warehouses with capacity of 35,000 tons each have been provided for storage.

New Montana Tungsten

Minerals Engineering Co. of Grand Junction, Colo., has brought into production its newly acquired Red Button tungsten mine in Beaverhead County, Mont., and is now turning out approximately 5000 units of tungsten trioxide monthly. An additional 5000 units are being produced at the firm's other Montana property, the Brown's Lake, near Glen. Concentrates from the Glen mill are refined at Salt Lake Tungsten Company's refinery, which is jointly owned by Minerals Engineering and Sylvania Electric Products Corp.

Plans Mexican Sulphur Plant

Fish Service de Mexico, S.A., a subsidiary of Fish Service Corp. of Houston, will build a $3,500,000 Frasch-type sulphur plant for Central Minera, S.A., the Mexican subsidiary of Texas International Sulphur Co., also of Houston. R. R. Herring, president of Fish Service de Mexico, said the plant will be built on the 123,000-acre sulphur concession of Central Minera on the Isthmus of Tehuantepec in Mexico.

The plant will have a daily capacity of 1000 tons and is scheduled for completion March 1, 1958. Fish, besides constructing the plant, will train management personnel and maintain active control of the facilities when completed.

Oregon Land Withdrawal Opposed

The city council of Rogue River, Ore., has informed the Bureau of Land Management of its opposition to the proposed withdrawal of public lands adjacent to the Rogue River.

In a letter signed by Mayor Phil B. Engle and the entire council, the city's position was stated as follows:

"We, the city council and Mayor of Rogue River, hereby protest the blanket withdrawal of the public lands adjacent to the Rogue River. We definitely oppose the withdrawal of lands classified as mineral, and suggest that the Oregon State Department of Geology & Mineral Industries act as arbitrator to those lands classified as mineral.

"We are for the establishment of recreational areas on the Rogue River, but oppose the withdrawal of potential mineral lands. Southern Oregon must rely in the future on its mineral potential to take care of its increased population.

"At the present, we are subject to widely fluctuating employment due to the fact that both our lumbering and tourist industry is seasonal.

"We need the stability of the mineral producing industries to maintain our economy."

Lignite Production Increased

The production of lignite coal in North Dakota totaled 3,042,517 tons during the fiscal year 1956, according to George B. Easton, state mine inspector. This was 62,792 tons more than the total for the preceding year.

Seventy mines were operating during this period, with 61 of them being strip operations.

Easton reported there has not been a fatal mining accident in North Dakota during the past six years.

Zinc Plant to Be Modernized

Consolidated Mining & Smelting Co. has announced a $1,360,000 modernization program for its zinc plant located at Trail, B. C. Work, to be started early in 1957, will include installation of two 150-ton electric induction melting furnaces to replace oil-fired furnaces. A 300-ton electric furnace installed in 1952 has operated successfully, the company reported. New gas filtering and dust collecting equipment also will be installed and storage and loading facilities improved.

Homestake Announces Pact

Homestake Mining Co. reports that it has entered a new agreement covering uranium exploration on property in the Ambrosia Lake area of New Mexico. The company said a subsidiary, Homestake Exploration, Inc., will explore property of Entrada Oil & Copper Corp., Albuquerque. The agreement covers exploration and mining and milling of any uranium ore found.

Bunker Hill to Expand

John D. Bradley, president, The Bunker Hill Co., has announced a $15,000,000 program which will provide for expansion and modernization of plant and equipment and enlargement of by-products recovery facilities for the 70-year old lead-zinc mining and smelting company with principal operations at Kellogg, Idaho. The program is to cover a five-year span.

Bradley estimated 1956 sales at approximately $56,000,000, and predicted that by 1960, Bunker Hill sales would reach $70,000,000. Net current assets of more than $16,000,000 are the highest in the history of the company, he said.

Utah Uranium-Silver Project

Western Gold & Uranium, Inc., has announced completion of its silver mill and initial processing of uranium-silver ore at its Silver Reef property near Leeds, Utah.

The company's Big Hill mine at the Silver Reef is reportedly the only one in the country yielding ore containing commercial amounts of both silver and uranium. Abundant dumps from old silver mines in the area, which contain from 6 to 16 oz of silver per ton, also will be processed through the new mill.

The uranium-bearing ore, after extraction of the silver, will be shipped to Vitro Uranium Company's mill at Salt Lake City.

Ore Exposures in Idaho

Development work on the 2500-ft level of the New Purim area west of Wallace, Idaho, has opened several short zones of silver-copper ore, a Polaris Mining Co. official has announced. The 2500-level west heading now is about 600 ft west of the Silver Summit mine boundary. Ore found so far has been "in-and-out" or "spotty" like that on lower levels, resulting in high-cost exploration and mining, he said.

Plans Republic Area Study

The Atomic Energy Commission has decided to make a field survey of uranium showings in the Republic, Wash., area.

Robert J. Meehan, Salt Lake City, chief of the ore reserves and mining activity branch of the AEC, said two AEC geologists will spend a month or two in the Republic area this coming field season.

They will work with local operators and check each prospect, he said. They also will do geological mapping and sampling and make a report which may benefit the operators by suggesting "certain approaches" to their problems.

Permits Mining of Iron Sands

The provincial cabinet has lifted a reserve on exploration for iron ore in the black sands of Graham Island, one of the Queen Charlottes, to pave the way for a steel industry in British Columbia, according to Mines Minister Kenneth Kierman.

The government will consider applications for special one-year placer mining leases, he said. Each lease will be limited to 15 square miles, and the area to be explored must be rectangular.

After one year's exploration, the lease holder must submit an exploration program showing that within two years of production he can produce 1,000 tons of pig iron per week for the B. C. market at competitive prices.

Tungsten Mill Readied

The finishing touches are being put on a new custom tungsten mill at a site several miles north of Inyokern, Calif.

Glenn Hatton and M. C. Carlson, lessees of the High Peak mine, plan to open the mill in the near future. It will be completely powered by electricity, and modern classifying cones and tables will be used.

While the mill primarily will process ore from the High Peak mine, it will also be open to miners with suitable ore at custom rates.

Federal Acquires Property

Federal Uranium Corp. has acquired three new uranium properties and obtained interest in four mining operations in other minerals, according to a semiannual report to stockholders. The new uranium claims are in Wyoming's Big Horn Basin.

Non-uranium properties recently acquired include lead and gold operations in Nevada, a copper property in Arizona, and a silver operation in Idaho. Generally, agreements on these properties establish Federal as the operating company. Federal will recover its initial expenditures on each property out of the first ore shipped.

Nabob Starts Milling Ore

Nabob Silver-Lead Co., Wallace, Idaho, started milling development ore on a one-shift basis in January. Drift muck from the 180-ft winze level is yielding about 70 tons of ore daily, according to C. C. Dunkle, vice-president and manager.

To Close Buying Station

The uranium-ore buying station and sampling plant operated near Globe, Ariz., by the Atomic Energy Commission since July, 1955, will cease accepting uranium ore at the close of business on June 30, 1957. The Commission reported that the Globe station has failed to stimulate development in the district sufficiently to warrant the construction of a processing plant, which is the ultimate purpose for establishing buying stations. The few properties still operating will be offered contracts to deliver ore until the closing date.

Oregon's Production Higher

Oregon's mineral production in 1956 had a record value of $34,970,369, according to preliminary annual figures compiled by the Albany, Oreg., regional office of the Bureau of Mines.

The valuation was up ten percent from 1955 and eight percent from 1954, the previous record year, the Bureau said.

Cement and nickel were credited for most of the increase. Sand, gravel and stone accounted for more than half the total value. Chromite production rose 56 percent to $709,000,000, mercury output 78 percent to $487,500, and gold production 45 percent to $86,800. Uranium shipments totaled 400 tons compared with about 300 tons in 1955.

Radon Mine Shows Profit

Profits from Radorock Resources, Inc., Radon mine have been sufficient to completely reimburse the operating company, Hecla Mining Co., for its development expenditures totaling $817,076, an interim Radorock report to stockholders has disclosed.

The final payment on Hecla's costs of developing the mine was made in October, and since then Radorock and Hecla have been dividing the operating profits. Under the agreement, Radorock receives 75 percent of net and Hecla receives 25 percent of net, after all royalties. Radorock also owns a 7½ percent royalty.

Montana Mining Sets Record

The value of minerals produced in Montana in 1956 was up 20 percent over 1955 to a record $201,900,000, the Bureau of Mines said in a preliminary annual report prepared in its Albany, Ore., regional office. Copper, fluorspar, petroleum and zinc primarily were responsible, the Bureau said. Value of coal and manganese production declined substantially.

Montana's 1956 copper output was up an estimated 19 percent from 1955. Gold production recorded a significant increase for the second consecutive year. Total output rose 17 percent. Zinc production was up five percent to nearly 72,999 tons, the report said.

State Named Uranium Center

New Mexico, with 68 percent of the uranium reserves of the country, has become the "center of the uranium mining industry in the United States," Representative Dempsey (D-N. M.) recently stated.

Dempsey, a member of the congressional joint committee on atomic energy, cited figures in the 21st semi-annual report of the Atomic Energy Commission as basis for his claim.

The report showed that the AEC has now invested more than $300,000,000 for uranium research and development work and plants in New Mexico. This figure does not include community facilities at Los Alamos, which are carried on the AEC books at $52,000,000.

Utah Lime Plant Planned

A $3,000,000 lime mill which will employ 90 men will be constructed near Delle, Utah. Ernest Mantes, president of the Tooele County Chamber of Commerce said he had been notified by the Marblehead Lime Co., Chicago, that it plans to build a mill to process the huge lime deposits in the area for commercial use. The company is negotiating with the Western Pacific Railroad Co. to extend railroad tracks to the site. Processed lime from the proposed mill will be purchased by U. S. Steel for use at the Geneva Works in Provo, Utah.

Conjecture Development

Extensive development at the Conjecture mine at Lakeview, Wash., is now getting under way, according to R. W. Neyman, president of Federal Uranium Corp., which has acquired an interest in the property.

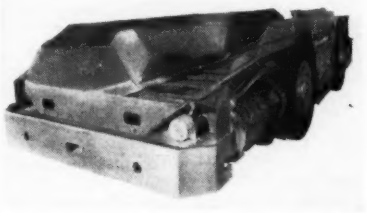
Neyman said $200,000 will be expended to explore the Conjecture at greater depth. A 200-ft two-compartment shaft is being sunk on the property on Gold Creek east of the old town of Lakeview. Ultimately it is planned to deepen the shaft to explore the St. Regis formation.

Manufacturers Forum

A-C Powered Shuttle Car

A TEN-TON CAPACITY shuttle car that operates on 440-v three phase, 60 cycle alternating current has been announced by the Joy Manufacturing Co.

Similar in size and general appearance to the company's 10-SC direct current model, the a-c powered car has



five motors with a total of 90 hp. There are no power reducing transmissions, clutches, mechanical differentials, and clearance reducing cross-shafts.

Other points noted include circuit breakers in the controller, disc brakes and built-in electrical braking, forced ventilated controller and 12-v lighting system.

More information is available from Joy Manufacturing Co., Dept. HH, Oliver Bldg., Pittsburgh 22, Pa.

Huge Hoists Ordered

WESTINGHOUSE ELECTRIC CORP. has been selected by the Anaconda Co. as the supplier of electrical equipment for two mine hoists at Anaconda's Ryan shaft in Butte, Mont. Sinking of the Ryan shaft is expected to be under way early this year.

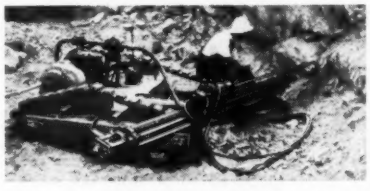
Each hoist installation, to be completed in the fourth quarter of 1957, will include two 3000-hp 600-v d-c motors operating at 500 rpm. The two 3000-hp motors on each hoist will be powered by a 5000-kw 600-v 514-rpm motor-generator set. The two 2500-kw generators are driven by a 7000-hp 2300-v synchronous motor with 250 percent pull-out torque. The synchronous motor is energized by means of a full voltage air break drawout type switchgear unit.

The hoist will operate from four hoisting levels: the shallowest being 1636 ft and the deepest being 4720 ft below the collar of the shaft. The 26,000 lb skip will haul a pay load of 36,000 lb at a maximum speed of 2846 fpm with total cycle time, including loading time of the skip, less than two minutes from the 4720-ft level.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

Rock Drilling Crawler

WITH AIR-OPERATED crawlers, this rig, designated the MM-2 "Drillcat," is entirely self-propelled with drill, mast and air power mounted for one-man operation. The machine con-



sists of Thor's 105M Drifter Rock Drill and the BW-2 Wagon Drill Mast mounted on the crawlers and is equipped with twin, reversible 7½-hp air motors. The rig also has a hydraulic boom to raise or lower the drilling mast. According to Thor Power Tool Co., Aurora, Ill., the Drillcat performs the same vertical, horizontal and angle rock drilling operations as the Thor Wagon Drill.

Odometer

DESIGNED TO RECORD travel distances of Caterpillar track-type Tractors, the odometer can be mounted on both spoke-type and disk-type idlers. Recently announced by Caterpillar Tractor Co., Peoria, Ill., the unit reportedly gives excellent accuracy in the low speed ranges, registering positive mileage in both forward and reverse gears. It is inoperative in fifth gear.

24-Yard Scraper

INCORPORATING TWIN-POWER—the use of two engines driving separate axles through separate transmissions—Model TS-24 has a 24-cu yd struck capacity. A 300-hp diesel in the overhung type tractor and a 218-hp engine located behind the scraper

serve as a built-in pusher. Allison Torqmatic Drives for each engine permits changing from one of the three speed ranges to another under full power without clutching.

Detailed specifications and descriptive literature can be obtained by writing Euclid Division, General Motors Corp., Cleveland 17, Ohio.

Oxygen Inhalator Kit

A PORTABLE oxygen inhalator kit, known as the Davis Oxygen Inhalator, contains complete equipment for the administration of oxygen, including two cylinders containing a half hour's supply of oxygen.

Full information is available from Safety Division, Davis Emergency Equipment Co., 45 Holleck St., Newark 4, N. J.

Motors

TOTALLY - PROTECTED, vertical solid shaft P-base motors for all vertical pump installations have been announced by Reliance Electric and Engineering Co., Cleveland 10, Ohio.

This line of motors, with normal thrust bearings in all sizes from 1 to 40 hp and high thrust in sizes from 1 to 15 hp, are available in Protected, Totally-Enclosed, or Explosion-Proof enclosures. The standard enclosure for Reliance Explosion-Proof P-Base Motors meets Underwriters' Laboratories specifications for performance under conditions covered by Class I, Group D, and Class II, Groups E, F and G.

Truck-Mounted Crane

A CAB-BESIDE-ENGINE carrier is now available as an optional with the Pitman Hydra - Lift, truck - mounted crane with maximum lifting capacity of 6500 lb. The carrier has a wheelbase of 144 in., permitting operation in close quarters. The operator can drive the truck and operate the crane from the same seat.

Three other optionals announced are a "high-mounted" boom which hinges at the top of the crane's mast and telescopes hydraulically from 17 to 27 ft, a hydraulically-driven winch, and a personnel basket which can be attached to the boom tip and permits a man to work at heights up to 40 ft.

For full details on Hydra-Lift and its new optionals, write Pitman Manufacturing Co., 300 West 79th Terrace, Kansas City, Mo.

Shaft Jumbo

BETTER CONTROL of hole pattern and direction, better fragmentation, use of larger drills for faster

drilling, drilling complete rounds in place of the benching method and safer operation—these are the advantages claimed for the Hydra-Boom Shaft Jumbo. In addition these units can reportedly be tailor-made for any shaft size. Write for flier 4188 to Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

Hose End

A CLAMP-TYPE hose end which is said to provide maximum versatility in high-pressure lines for air, hydraulic fluids and steam has been announced by The Weatherhead Co., Fort Wayne Division, Fort Wayne, Ind.

Advantages claimed for this hose end are: couples readily on other types of hose, meets practically any original equipment of field replacement hose-end need, requires no hose skiving or special tools, and may be used over and over again. Of malleable iron, it is available in the following sizes: ¼, ⅜, ½, ¾, 1, 1¼, 1½ and 2 in.

Metal Powder Spray Unit

HIGH CAPACITY AND EFFICIENCY are claimed for a metal spray unit that applies hard-facing alloys and other metals in powder form. Available from Wall Colmonoy Corp., 19345 John R. Street, Detroit 3, Mich., the Model C-2 Spraywelder is designed for use in applying hard-facing powders to most types of steel, cast iron and copper parts by the Sprayweld process. In this process, the powdered alloys are first applied by spraying and then are fusion-bonded to the part by heating with an oxyacetylene flame. Metal spraying operations using aluminum, zinc, copper, nickel, stainless steel, brass, lead or high temperatures brazing alloys in powder form can also be handled by the unit.

The Model C-2 Spraywelder components are mounted on a panel that may be either wall or pedestal mounted. The complete unit includes an aluminum pistol, chromium-plated hopper, carburetor, combination air regulator-filter, and suitable oxygen, acetylene and powder hoses and fittings.

Dust Collector

A CABINET-TYPE dust collector, the Model 123 has a dust storage capacity of ten cu ft and a filter area of 300 sq ft. Its five-hp motor moves approximately 2000 cfm of air through an eight-in. inlet at speeds of more than a mile a minute. Static pressure for this inlet is 3½-in. water.

The motor is internally mounted in the clean air stream above the filters. Manual starter with overload protection is standard equipment, while explosion - proof motors and magnetic starters are available at extra cost.

Additional information is available by writing Department KP, Torit Mfg. Co., 287 Walnut St., St. Paul 2, Minn.

Fluorimeter

HOUSED IN A METAL CABINET, the Mt. Sopris model FL-210 Fluorimeter is an instrument for the quantitative analysis of uranium minerals, and for uranium determinations in geobotanical, hydrogeochemical and geochemical prospecting. It reportedly has been designed to work over a wide range of ambient temperatures and input voltages and thus is suitable for both field and laboratory use. Further information may be obtained from Mt. Sopris Instrument Corp., 1320 Pearl St., Boulder, Colo.

Electrical Wires and Cables

TWO KINDS of Type U. S. E., Style RR nonmetallic-sheathed 600-v cable are being offered under the Bronco label. One kind is suitable for direct burial in the earth. The other is a general purpose cable designed for raceways, ducts, or open wiring. Both are made with a Neoprene outer sheath and heat-resistant, super-aging rubber insulation. Both kinds are available with either a solid single conductor, sizes 14 AWG through 8, or a stranded single conductor, sizes 14 through 4/0.

Other items include Bronco 66 Certified Type SO Shielded Cords, Bronco 66 Shielded Control Cables, Bronco Telephone Distributing Wire and Bronco Miners' Lamp Cord.

Some of the most severe operating conditions portable cords and cables face, occur when they are used with retractable take-up reels, such as on foundry sand cutters, lifting magnets, cranes, and mine drills. To extend the life of power lines used under these circumstances, Western Wire has designed and is manufacturing special cords and cables which have acquired the unofficial designation Type "P & R."

For stationary installation in important control circuits, 600-v control cables have been added to the Bronco 66 Certified line of portable control cables.

These and other items are described in detail in a catalog available from Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.

Trailer

A 35-TON CAPACITY REAR DUMP TRAILER, designed for transporting light weight, adhesive materials such as bauxite ore, has been announced by Athey Products Corp., Chicago, Ill.

Called the PRB21, it is powered by the Caterpillar DW21 Tractor,

equipped with Hydrotarder for supplemental braking on sustained downhill hauls. Concentrated body heat is produced by conducting engine exhaust gases to the critical areas of the trailer interior body plates where ore tends to stick. The "seal" of this material is said to be broken by the heat and ore slides out quickly and completely. High alloy, heat treated, premium steels give maximum capacity and lowest vehicle weight-to-load ratio of any Athey hauling unit.

Drill Head

A DRAG BIT drill head that is reputed to speed up auger drilling of blast holes is known as Model AP. It is a three-wing prop type head designed for use with special patented carbide-tipped bits. The latter have tapered shanks that drive-fit firmly in the drill head, according to the company, so that wedges or screws are not needed. Model AP is available in five sizes for cutting holes of from 4⅝ to 8⅝ in. in diameter. For data, request catalog 101 from Austin Powder Co., Cleveland, Ohio.

Field Coil Insulating System

AN INTEGRATED FIELD COIL recently announced by Allis-Chalmers has a newly developed insulating system designed to protect electric motors and generators against atmospheric contaminants and destructive mechanical forces. It is reportedly well suited for applications requiring chemical resistance, oil and moisture-proofness, or sealing against atmospheric contaminants such as carbon black, dust and dirt.

Currently available for synchronous and d-c machines subject to severe duty cycling in Class A and B temperature classifications, the integrated field coil construction is described in leaflet O5R8525, copies of which are available on request from Allis-Chalmers Mfg. Co., 972 S. 70th St., Milwaukee, Wis.

Coupling for Pipe

A FLEXIBLE coupling for grooved end pipe is now being marketed by the manufacturer, Charles E. Manning Co., 4700 Clairton Blvd., Pittsburgh 36, Pa.

Stocked in sizes one to eight in., with other sizes on request, the Alumiron Coupling is available in either malleable iron or aluminum and is furnished with Buna N or Neoprene gaskets. For high temperature applications, a Silicone compound is supplied.

For use on steel, aluminum, cast iron, wrought iron and spiral weld pipe, the Alumiron can be coupled or uncoupled by means of two bolts which pass through the coupling halves. A tight seal is made by drawing up the two half housings with a socket wrench.

The couplings flexibility is said to permit the pipe line to follow the terrain's dips and grades.

— *Announcements* —

The **Timken Roller Bearing Company's Steel and Tube Division** recently completed a $1¼ million expansion program of its tube mill when its renovated and modernized number two piercing mill resumed operations. Now capable of producing alloy seamless tubing 40 ft in length weighing up to 3500 lb, the modernized tube mill will help meet the demand for heavy wall seamless tubing from the country's oil industry.

Goodman Manufacturing Co., Chicago, has named **Ronald Whiton** as sales engineer. A graduate of the Michigan College of Mining & Technology and with experience at properties of Calumet & Hecla, Whiton will represent the company in upper Michigan, Minnesota and parts of Canada.

Also announced by Goodman are personnel changes in its Mancha Storage Battery Locomotive division. New general manager, replacing **C. E. Stoltz** retired, is **J. A. Appleton** and new chief engineer is **R. M. Ansel**. Appleton retains his duties as manager of sales.

Van H. Leichliter has been named president of the **American Steel & Wire Division** of the **United States Steel Corp.** He succeeds **Walter F. Munford** who becomes assistant executive vice-president of operations of the corporation with headquarters in Pittsburgh. **Harry L. Jenter** has been promoted to vice-president of operations of the Steel & Wire Division.

Max J. Kennard has been appointed chief engineer of the Engineering and Construction Division of **Southwestern Engineering Co.**, Los Angeles.

Dow Chemical Co. has started construction of terminal distribution facilities at Grants, N. M., to serve the expanding chemical requirements of uranium producers in the Southwest.

The installation, expected to be in operation in mid-1957, will be equipped to handle storage and distribution of 50 percent caustic soda solution, soda ash and other Dow chemicals for the mining industry.

CATALOGS & BULLETINS

ROPEOLOGY. *Macwhyte Co., Public Relations Dept., Kenosha, Wis.* Named Premium Whyte Strand, this Extra Improved Plow Steel wire rope is said to be 15 percent stronger than Monarch Whyte Strand Improved Plow Steel wire rope. It is offered in both the 6 by 19 and the 6 by 37 wire rope classification, in Independent Wire Rope Core construction only. Further announcements in Bulletin 5685 include special wire rope assemblies made of swaged fittings permanently attached to wire rope.

MOTORS. *General Electric Co., Schenectady 5, N. Y.* Bulletins GEC-1026A and GEC-1027A give buying information on a selected group of General Electric motors. Included are application data, ratings, and prices for fractional horsepower motors, integral-horsepower polyphase and single phase induction motors, motors and control for part-winding starting, gear-motors and resilient-base integral-horsepower induction motors.

AIR COMPRESSORS. *Kellogg Division, American Brake Shoe Co., Rochester 9, N. Y.* Catalog covers the company's line of ⅓ to 20-hp air compressors for automotive and industrial use. Well illustrated, the booklet gives specifications on single and two-stage models, portable models, tanks, pumps, and accessories. Useful charts, data, and information on compressed air are also included.

MICROMEROGRAPH. *The Sharples Corp., Research Laboratories, 424 W. 4th St., Bridgeport, Pa.* Bulletin 101 discusses the Sharples Micromerograph, an instrument which is said to provide rapid particle size distribution determinations of powdered materials by the application of Stokes' Law of Fall for the velocity of particles falling through a gas. The Micromerograph is useful both in production and quality control and as a research instrument.

WELDED STEEL SCREENS. *Bixby-Zimmer Engineering Co., 961 Abingdon St., Galesburg, Ill.* The use of stainless steel screens in heavy-duty separating and conveying equipment is covered in a book entitled, "Bee-Zee Screens Make You Money." Special emphasis is given to screen rod shapes developed for specific purposes. The book illustrates the various screen shapes that can be created for specific installations.

TRACTOR SHOVELS AND SCRAPERS. *Construction Machinery Division, Allis-Chalmers Mfg. Co., Milwaukee, Wis.* Three pieces of literature are available. Usage information of the HD-11G and the HD-6G Diesel powered crawler tractor shovels highlights MS-1137 and MS1126 respectively. The four pull-type scrapers in the Allis-Chalmers Construction Machinery line are featured in the third piece of literature, MS-1149.

CONICAL SCRUBBERS. *Hardinge Co., Inc., 240 Arch St., York, Pa.* Bulletin No. 37-B contains a complete description of the Hardinge Conical Scrubber with ratings and dimensions, as well as approximate capacities in operation. Applications for which the scrubber is best suited are discussed, and numerous installations are shown pictorically.

(Continued on page 100)

(Continued from page 99)

MOTOR SELECTOR. *Reliance Electric and Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio.* "Reliance Motor Selector" gives information on how to select a-c motors for specific applications. Included in Bulletin B-2103-1 are such data as speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables, and dimension charts and mechanical modifications for all frame sizes from 182 to 6085. Two pages are devoted to a pictorial glossary of motor enclosure terminology.

SLURRY PUMP. *Dorr-Oliver Inc., Barry Place, Stamford, Conn.* Bulletin No. 5003, "The Oliver Diaphragm Slurry Pump," describes the features, applications, sizes and capacities, special designs, installation instructions and power requirements of this slurry pump. Also included are photographs, wash and line drawings, and a graph indicating power requirements of the unit.

POWER PIPE PUSHING. *Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo.* Although this manual is used in conjunction with the company's Speed-Three hydraulic pipe pusher, it is claimed to be universally applicable. The described and illustrated methods shown can be used in connection, in most cases, with any type of pipe pusher, whether hand or power operated, and will prove valuable to anyone concerned with underground pipe or conduit installations.

TEMPERATURE CONVERSION CHART. *Moeller Instrument Co., Richmond Hill 18, N. Y.* Moeller is again offering without obligation its temperature conversion chart to those having use for this pocket size aid. The tables of Fahrenheit and Centigrade temperature equivalents are a time saver to anyone having frequent occasion to convert from one temperature to the other. The reverse side of the 8½ by 3½-in. chart illustrates by means of an animated demonstration, the easy reading qualities of thermometers made with the Moeller Glass Red Reading Column.

SEMI-AUTOMATIC WELDER. *American Manganese Steel Division, Dept. A, Chicago Heights, Ill.* Bulletin No. 6-56 includes cross-sectional and cutaway drawings of the AMSCO MF Semi-Automatic Welder and its component parts and explains how the machine operates. In addition, the brochure has a section on the AMSCO Tubular Electrodes for semi-automatic manganese steel build-up and hardfacing plus a list of their applications in different industries.

ADAPTERS FOR TUBE FITTINGS. *Tube & Hose Fittings Division, Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.* Parker Catalog 4360 shows straight thread plugs and adapters, o-rings for straight thread fittings, and steel and brass pipe fittings.

BUTTERFLY VALVES. *The Henry Pratt Co., 2222 South Halsted St., Chicago 8, Ill.* This 40-p. catalog is designed to help engineers select valve types, understand their characteristics, and determine space requirements. Bulletin B-2 includes such data as: pressure drop and flow tables, conversion tables, theory and application, recommended materials, and describes Henry Pratt Rubber Seat Butterfly Valves from four-in. diam up, for handling liquids and gases.

TRAILER DUMP UNITS. *Department 187, Anthony Co., Streator, Ill.* Featuring the company's Frameless trailer units, the folder contains complete feature details together with hoist specifications and load ratings for the Anthony single-axle and tandem-axle units. One page describes the "inch worm" action of these Frameless dump trailer units.

BELTING. *Boston Woven Hose & Rubber Co., Boston 3, Mass.* Complete data on conveyor, elevator and transmission belting is included in this 32-p. belting catalog. Reference tables and specification information provide a working guide for engineers and purchasing agents. Boston's balanced belt construction is explained. This feature is said to insure even tension throughout the various plies in the belt and prolongs belt life.

LIFT TRUCKS. *Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.* This booklet is designed for quick reference of 25 different Hyster industrial truck models ranging in capacity from 1000 to 30,000 lb. Spotlighted are Hyster's 3000, 4000 and 5000 lb capacity series on pneumatic tires, the Hyster "Space Saver" series of the same capacity on cushion tires and the Hyster "Monomast" Lift Trucks. An advanced-design yard crane, Hyster's model KE "Karry Krane" of 10,000 lb capacity, is also described.

Index to Advertisers

Euclid tractors and scrapers

lower stripping costs for mines and quarries

Tremendous power, speed and maneuverability make the 436 h.p. Euclid TC-12 Twin-Power Crawler a top performer in heavy duty mine and quarry work. No other tractor matches it for low cost production in stripping overburden, clearing, stockpiling, building haul roads and other big tractor jobs.

Euclid scrapers have struck capacities from 7 to 24 cu. yds. with engines ranging from 143 to 518 h.p. The complete line, including both two axle and three axle models, has hydraulic lever action that eliminates down-time caused by cable breakage. Good maneuverability and fast travel speed reduce cycle time . . . help move more loads and more yards for lower cost stripping operations.

Check the many advantages of "Eucs" for your operation . . . have a Euclid dealer show you why ***Euclids are your best investment.***

•

EUCLID DIVISION, GENERAL MOTORS CORP., Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

EUCLID

This fire truck delivers 100 gallons of water a minute, with a 450-foot head.

New M-S-A® Mine Fire Truck *mechanizes* fire fighting

Here's the mechanized way to fight underground fires.

Designed for mobility and fast hook-up, the new Model 2100 M-S-A Mine Fire Truck provides the volume and pressure to put fires out in a hurry. Rugged, low-slung, all-steel, this unit will negotiate a No. 2 turnout with its standard eight roller bearing wheels. Wheels have 5-inch tread for easy maneuvering.

Standard overall length of this Mine Fire Truck is 18 feet to centerline of automatic couplers, with an overall width of 7 feet. Height, up to 50 inches (2100 gallons) determines the tank capacities. Tank fills easily through a 6-inch breather hole at top.

Painted with high visibility yellow enamel, the Model 2100 has a 20 hp 3500 rpm electric motor which couples directly to a two-stage centrifugal pump. Combination fog and straight stream nozzle is standard equipment. The top of the tank contains storage capacity for 800 feet of 2-inch M-S-A Fire Hose.

Write for our bulletin for complete details on the performance of this unit.

MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At your Service: 76 Branch Offices in the United States
MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.
Representatives in Principal Cities in Mexico, Central and South America
Cable Address: "MINSAF" Pittsburgh